November 7, 1945

NATIONAL PETROLEUM NEWS

TECHNOLOGY DEPT

The War's Best Civilian Job Nears Completion

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"The job is just about over, Mr. Secretary," Deputy Petroleum Administrator Davies tells PAW Ickes, handing him a brief summation of OPC-PAW activities from the opening of operations May 28, 1941, right up to date. The only important date on PAW's closing agenda is an appearance before the Senate Petroleum Investigating Committee, an appearance that will send PAW's journeys to Capitol Hill well over the 100 mark. The history of OPC-PAW and its remarkable record will be found in this issue of NPN, starting on page 17

The story of how American produced gasoline and lube oil powered the strategic bombing which contributed heavily to Germany's collapse is one which can be read with a great deal of satisfaction by members of the American Petroleum industry. Starting on page 60, NPN presents highlights of the War Department's survey of how Germany's oil industry was crippled.

REFINERY MANAGEMENT AND PETROLEUM CHEMICAL TECHNOLOGY EDITION—In 2 Sections, Section 1

Millions of young men and women will be released from the armed forces during the next 12 months.

Are They Coming Home to You?

Many new cars are being sold to many new buyers—right now, in your own locality—and many more will find new owners in the months to come. Service stations seeking to hold returning old customers, and win their share of the new, must keep their appearance, facilities and service up-to-date. No item of equipment adds more to the sales appeal of a station than gasoline pumps. None returns more profit per dollar invested. Tokheim pumps proved in service for 44 years are a natural choice for operators planning either a minor or major job of post-war station improvement. Call your Tokheim man, or write factory.

TOKHEIM OIL TANK AND PUMP CO.
DESIGNERS AND BUILDERS OF SUPERIOR EQUIPMENT
FORT WAYNE 1 FOR 44 YEARS INDIANA

QUALITY
TOKHEIM
THE 4-SEASON PUMP

Awarded to Tokheim for outstanding achievement in the production of war material.

PEOPLE ARE CERTAINLY QUALITY-MINDED THESE DAYS
HOW DO YOU KNOW THAT ?
SO MANY OF THEM LOOK FOR THE ETHYL TRADE MARK ON THE PUMP!
IT MUST HELP YOUR SALES
YES, AND IT MAKES A LOT OF SATISFIED CUSTOMERS, TOO.

The Ethyl emblem on a pump speaks for itself. It tells the motorist that here is the high-quality gasoline he wants.

ETHYL CORPORATION
Chrysler Building, New York 17, N.Y.

They're looking for the Ethyl trademark on your pumps →

He Headed World Oil Survey Group

B. Brewster Jennings . . . . . Socony-Vacuum President

Heading the "Group on American Petroleum Interests in Foreign Countries" a summary of whose report to the Senate Committee Investigating Petroleum Resources was published in the Oct. 31, 1945, issue of NPN was a veteran of a quarter-century affiliation with the industry—B. Brewster Jennings, president of Socony-Vacuum Oil Co. Inc.

He started with Standard of N. Y. in 1920 and later became purchasing agent, real estate department manager and was a director of one of the two principal operating subsidiaries.

In 1935, he became assistant to the President, John A. Brown and in 1939 became a member of the board of directors, in charge of the company's transportation.

Early in 1942, he took leave of absence to direct United States Maritime Commission and War Shipping Administration tanker operations, returning Aug. 1, 1944.

BULLETINS

PICKETING CASE IN COURT

PHILADELPHIA—Five SKF Industries Inc. officials testified this week as a court fight began to determine legality of mass picketing at the company's strike-bound plants in Common Pleas Court here. The firm seeks an injunction to restrain Local 2898, United Steel Workers, C.I.O., from mass picketing.

COMPANY, UNION FILE BRIEFS

DETROIT—Attorneys for both sides filed briefs in State Circuit Court at Ithaca, Mich., on Refiners' Transport and Terminal Co.'s plea to make permanent the injunction restraining O.W.I.U. from interfering with the company's transports. Suit for $500,000 may soon be filed against the union, Ed Turner, R.T.T. Co. president, said.

WARNS OF C.I.O. ACTION

DETROIT — Small petroleum operators can expect a C.I.O. invasion says Joseph D. Hadley, executive secretary of the Michigan Petroleum Assn.

Indicative of the approaching trend, according to Mr. Hadley, is the case of C. K. M. Oil Transport Co. of Wayne, Mich., owned by Charles K. Miller, whose four trucks are idle since June 7 because of O.W.I.U. local No. 389's closed shop demand.

Delegates elected John A. Keeley, Illinois supervisor of motor fuel tax collections, chairman, and Chester C. Meyer, Indiana director of the motor fuel division of the state auditor's office, secretary.

Collections of more than $130,000,000 in Illinois, Indiana, Michigan, Ohio and Kentucky were announced.

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PETROLEUM NEWS
NPN
NEWSMAGAZINE FOR OIL MANAGEMENT MEN

Marketers Study FTC's Indiana Standard Action; Implications Seen Far-Reaching

Company Would Be Laying Itself Wide Open to Possible Prosecution Under Sherman Law if It Abides by Commission's Order

NPN News Bureau

WASHINGTON—Being studied and restudied by oil marketers everywhere is the decision of the Federal Trade Commission holding that Indiana Standard had violated the Robinson-Patman Act in selling gasoline at tank-car price to four jobber-retailers (see Oct. 31 NPN P. 10).

Implications of the decision seemed to be far-reaching, although the immediate scope of the order is confined to Standard's operations in the Detroit metropolitan area, but answers to many of the questions raised in the minds of oil men probably will not be forthcoming for another 18 months or more when the case finally has cleared through the courts.

And even after the courts have had their say, there will still be some questions left, FTC attorneys conceded, which can only be settled when, as and if directly raised from time to time in future proceedings before the commission. In the meantime, they indicated, possibility of the same conclusions reached in this case being applied in areas outside of Detroit will depend on whether circumstances in a given situation are similar.

That the Detroit case would reach the courts was a foregone conclusion. Standard of Indiana was expected to see to that.

FTC itself makes plain that it would welcome a court test. The reason is that it wants a ruling which will decide, once and for all, the issue of whether proof of self-defense in cutting prices is or is not superior to a contention that price cutting resulted in public injury through destruction of competition.

COMMISSION RELYING FOR FIRST TIME ON ROBINSON-PATMAN AMENDMENT TO CLAYTON ACT

In the Detroit case, FTC held that it was not—that Standard's pleading that prices were cut in good faith for the sole purpose of meeting the equally low or lower prices of competitor was no defense against a showing of price discrimination, the effect of which "has been" or "may be to substantially lessen competition or tend to create a monopoly or to injure, destroy or prevent competition." Thus the commission was relying for the first time on the Robinson-Patman amendment to the Clayton Act making discriminations due to differences in cost, market changes and marketability of goods the "only absolute justifications now available to a respondent charged with unlawful price discrimination."

The Robinson-Patman amendment of June 19, 1936, holds, in effect, that the public interest in maintenance of free competition is larger even than that of an individual who, in good faith, discriminates as to prices, but the courts have never passed on the legality of this position. Should it be upheld, administration problems of the FTC would be much simpler than under the original Clayton Act which made meeting of competition in good faith a complete or absolute justification and forged FTC to the difficult task of establishing bad faith.

There were signs, too, that the Justice Department might also be taking some interest in the case for reasons that have to do with the anti-trust laws.

In this connection, it was pointed out here that one effect of the FTC decision is to require jobbers to sell at the tank wagon price, whereas the Sherman Act provides that prices for resale may be fixed only where the purchaser is an agent of the seller. Under the FTC ruling, however, Standard may offer any discount it wants to jobbers, so long as they sell to their dealers at tank wagon prices, where the jobbers' dealers compete with Standard's dealers.

COMPANY WOULD LEAVE ITSELF OPEN TO POSSIBLE ACTION UNDER SHERMAN LAW

As a result, the Indiana Company would be laying itself open to possible prosecution under Section 1 of the Sherman law if it abides by the commission order.

That the implications of the case are many is readily apparent from a reading both of FTC's 15½ pages of "findings of fact" as to Standard's operations in the Detroit metropolitan area, and of the resulting order to "cease and desist."

Briefly, the commission found that Standard was selling its Red Crown brand of gasoline to four resellers at the tank car price, 1½c off the tank-wagon price charged other retailer-purchasers, having "arbitrarily classified" each as a jobber although one (Ned's Auto Supply Co.) sold all of its gasoline at retail and the other three (Citrin-Kolb Oil Co., Stikeman Oil Co., Inc., and Wayne Oil Co.) sold at retail as well as wholesale. For a time also, the Standard Company was found to have allowed Ned's Auto Supply a price 5c per gal. off the regular tank-wagon price to all other retail dealers. Emphasized by the commission, in paragraph five of its findings, was this point:

"In allowing jobber classification in the Detroit metropolitan area to the four jobbers hereinbefore named, the respondent required only that said jobber purchase substantial quantities of gasoline, own or control bulk plants where gasoline in large quantities could be delivered, and have sufficient financial standing or credit rating to warrant the extension of credit. There was no requirement that said jobbers should sell only at wholesale."

Delivery to the four jobber-retailers, FTC found, were "generally made by tank car, and after Feb. 1, 1940, by transport truck, direct from respondent's River Rouge terminal."

As to the effect of the price discriminations granted the four, the commission said it had been to give them a "substantial competitive advantage . . . in their retail operations over other retailers of gasoline, including retailer-customers of the respondent. This competitive advantage is capable of being used, and by Ned's Auto Supply Co. and to some extent by Citrin-Kolb Oil Co. has been used, to divert large amounts of business from other retailers of gasoline, including customers of the respondent, with resultant injury to them and to their ability to continue in business and successfully compete with said dealers in the retailing of gasoline."

ORDERS ISSUED BY FTC

This being so, the FTC said, and Standard having failed to establish that the discriminations were the result either of differences in cost or changed market conditions, the company was ordered "to cease and desist from discriminating, directly or indirectly, in the price of such gasoline of like grade and quality as among purchasers (in the Detroit metropolitan area):

"1. By selling such gasoline of like grade and quality to competing purchasers at different prices.

"2. By continuing or resuming the discriminations in price referred to.

"3. By otherwise discriminating in price between purchasers of gasoline of like grade and quality in a manner and degree substantially similar to the manner and degree of the discriminations referred to . . . and in any other manner resulting in price discriminations substantially equal in amount to such discriminations.

"4. By selling such gasoline to some retailers thereof at prices different from the prices charged other retailers who in fact compete in the sale and distribution of such gasoline, pro-

vided, however, that this shall not prevent price differences of less than .5 cents per gallon which do not tend to lessen, injure, or destroy competition among such retailers.

"5. By allowing a lower price to any dealer, jobber, or wholesaler on gasoline sold by such dealer, jobber, or wholesaler at retail, than the price which respondent charges its retailer-customers who in fact compete in the sale and distribution of such gasoline with such dealers, jobbers, or wholesalers in their retailing activity, provided, however, that this shall not prevent price differences of less than .5 cents per gallon which do not tend to lessen, injure, or destroy competition with such dealers, jobbers, or wholesalers in the sale of gasoline direct to the consuming public.

"6. By selling such gasoline to any dealer, jobber, or wholesaler at a price lower than the price which respondent charges its retailer-customers who in fact compete in the sale and distribution of such gasoline with the retailer-customers of such dealers, jobbers, or wholesalers, where such dealers, jobbers or wholesalers resell such gasoline to any of its said retailer-customers at less than respondent's posted tank-wagon price or who directly or indirectly grant to any such retailer-customer any discounts, rebates, allowances, services or facilities having the net effect of a reduction in price to the retailer."

For answers to at least some of the questions raised by FTC's findings and the order, NPN went this week to Walter B. Wooden, assistant general counsel of FTC.

He was asked, among other things, whether the commission, in noting the fact that Standard had granted jobber classifications to the four resellers, meant that a seller could legally—and should—classify its customers and apply price brackets to each classification. If so, then how shall the customers be classified, NPN inquired.

FTC COUNSEL SAYS DIFFERENCES IN PRICE BRACKETS WOULD HAVE TO BE JUSTIFIED ON THE BASIS OF COST

Mr. Wooden's answer was that while the Robinson-Patman Act does not prescribe classification, it was his personal view that any resulting differences in price brackets would have to be justified on the basis of cost.

Mr. Wooden then was asked these questions:

Does FTC, or will it, approve classification by function? If so, who can do the classifying? Only the seller, and if so on what basis? Or can an industry committee or association set the classifications?

The answer to this series was that FTC never has approved classification by function, nor has it had to. But, Mr. Wooden warned, if the seller does classify, he brings himself in front of the target as to whether the classification is based on cost or is arbitrary. Moreover, he said, straight out classification by function is almost bound to be arbitrary, having no relation to costs. And as for the suggestion that possibly an industry committee or association might set the classifications, he pointed out that there have been any number of court rulings which would make this a violation of the anti-trust laws because of the price angle, and said that you can be sure that the FTC is not seeking to disestablish those principles.

On the subject of the evidence in the Standard Oil case, the assistant general counsel was asked whether the facts as stated in the findings (paragraph eight) constituted all the evidence in the case in support of the resulting charge destruction and prevention of competition. "If this is the evidence," NPN inquired, "then just how much business was destroyed or injured and competition lessened, and how was it measured?"

Mr. Wooden replied that, under the law, FTC doesn't need to show destruction, injury or lessening of competition, or even to measure the same. All it is required to do, he said, is to show discrimination in price, the effect of which may be to substantially lessen competition or tend to create a monopoly or to injure, destroy or prevent competition. In this respect, he pointed out, the FTC is in a quite different position from that of a jobber who might want to take a price cutter into court, for the jobber would be required to set out, measure and prove actual damage.

An implication in the findings that the commission will insist on exact and accurate cost separation by a seller in establishing cost justification for price differentials prompted NPN's next series of questions, which were:

"Does this mean that when a seller sets up a price bracket for a class that he must follow some detailed set of accounting rules in ascertaining the difference in costs between that class and another class of customers in order to establish his differential between brackets? Must every seller-jobber and major company who sell to retailers follow detailed costing? And will FTC set up the detail of the items to be charged each way?"

DECLARES FTC DOES NOT INSIST ON MATHEMATICALLY EXACT COST JUSTIFICATION

Mr. Wooden's reply was that FTC does not insist on mathematically exact cost justification—just some reasonable approximation of difference between price and difference in cost. The important thing is whether reasonable relationship is shown. However, it's another thing, he said, when you get into arbitrary differences that were based on other than cost differentials, for it seems to be just happenstance that a seller could justify those differences on a cost basis. To other portions of this question series, Mr. Wooden said that the answer on "detailed costing" was no, and that FTC would neither require nor set up the detail of the items to be charged each way. He went on that it is entirely conceivable that a seller will have no cost system at all, yet be able, from his long background of experience in the industry, to arrive at some reasonable approximation of costs.

Turning next to the "cease and desist" order itself, NPN asked whether the meaning to be drawn from Pt. 6 is that when anyone resells at less than the "posted price," the seller should quit selling until the cut pricing is stopped, and if the seller was expected to police price maintenance.

To this, Mr. Wooden replied that the law is quite liberal in upholding the sellers right to quit selling whenever he pleases. In fact, he said, the courts have gone so far as to say that he can quit for any or no reason at all.

To the question of how the FTC knows that a half-cent difference in price will not destroy competition, or injure it —as suggested by Pt. 4—Mr. Wooden said that the answer to that was that the commission doesn't know. The Robinson-Patman Act doesn't require it to take a position that any amount is a price discrimination, he said, the determination as to just what amount might destroy competition being left to the commission's own good judgment.

Midwest Oil Men Give Variety of Opinions Relative to FTC Move

NPN News Bureau

CHICAGO—A variety of opinion was the first reaction of the oil industry in the Midwest to the Federal Trade Commission's order against Standard of Indiana, Docket 4389, to "cease and desist" in sale of gasoline of like quality at different prices under circumstances found in the Detroit case.

Jobbers, oil marketing departments and attorneys are still studying text of the order in an effort to determine its ultimate effects.

Hugh L. Thatcher, Chattanooga, Tenn., chairman, National Council of Independent Petroleum Assns., is withholding opinion until after a meeting of the Council to be held here next week. He said the order might result in widespread changes in marketing where jobbers engage in both wholesale and retail operations.

Russel Williams, Indianapolis, president, Individually Branded Petroleum Assn., said he was having a look at the order and consulting with members. At first glance, it appeared to him that it applies to branded products only and does

not have anything to do with basic buying.

"The only way FTC comes into it," he said, "is where a trade marked product is sold at discriminatory prices to like buyers. A jobber has a right to offer unbranded products in any market at any price."

This opinion, however, is subject to change upon further study of the order, Mr. Williams said.

General counsel for a major company pointed out that gasoline can not be identified like attaching a label to a metal product, and the FTC order, he said, applies to both branded and unbranded petroleum products. He called the order a misfit economic theory not based upon sound law, and unless changed will apply company or industry wide.

'Evidence Does Not Hold Now'

"The evidence was taken in 1939-40 and does not hold now," he said. "Dealer discounts were predicated on 3.3c, which does not hold anywhere else. It is another of those things where a government agency is prosecutor, judge and jury, and merely affirmed its own judgment after filing the complaint."

If the rule holds, he continued, variations of over ½c in sales to jobbers in the same class will have to be supported by difference in cost figures. The order applies to fuel oil sales as well as to gasoline, he said. The difference between prices to small and large consumers can be only the saving in cost of big deliveries. Competition does not enter into it in his opinion.

Prices to Standard of Indiana's jobbers in Detroit cited in the case were probably frozen by OPA when the price freeze came in 1942 and that will have to be worked out before an increase could be made to comply with FTC's order. The Miller-Tydings Act, which permits states to pass laws so manufacturers can control retail prices of their products might enter into effects of the FPC decision, but only so far as the different states have passed such laws. All states have not done so, the attorney said. Since the order also applies to unbranded products, it will kill off track side operators where they retail and their suppliers are selling to others in the same community. Co-ops who buy at wholesale now and sell at retail will be affected by the order in the opinion of the attorney.

"These things," he concluded, "are the best evidence that the Robinson-Patman Act is in direct conflict with the Sherman Anti-Trust law, and there will have to be an amendment."

Foresees Drastic Marketing Changes

Midwest head of a major company marketing department declared the order would mean drastic changes in marketing if carried out. "It's so far reaching our legal department is studying it thoroughly," he said, "especially regarding dual operations (jobbing and retailing) here. The order is not clear on station rentals, which are another way of making concessions. Now that we are about rid of OPA, are we going to be regulated by another government agency?" he asked.

He declared the order was "full of dynamite" and wanted to know if the jobbers or dealers allegedly discriminated against could collect damages in court.

"If FTC can do that in Detroit, what about Chicago where price differences have been more competitive," he asked. "The whole thing looks like the entering wedge to give oil industry marketing a good airing. The general impression has been that they were just waiting until the war is over and government will move in."

A jobber, who does no retailing, said "looks like it's right down my alley, but there may be more to it than that." He had not yet read text of the order.

When is a Jobber Not a Jobber? How High is Up? FTC Has Industry Running in Puzzled Circle

By Elwin E. Hadlick
President, Northwest Petroleum Assn.

What is an oil jobber? Standard Oil Co. Ind. determined a jobber was one who purchased substantial quantities of gasoline, owned or controlled a bulk plant where gasoline in large quantities could be delivered, and sufficient financial standing to warrant extension of credit.

Mr. Hadlick

Federal Trade Commission says that those qualifications are not sufficient to make an operator any different than the general run of service station operators.

The industry is really confused over this order issued by FTC in a proceeding which has been pending before it since 1940. The case, docket 4389, involves an interpretation and application of Section 2 (a) of the Clayton Act, amended by the Robinson-Patman Act.

That section in its amended form has been on the books since 1936, but there haven't been sufficient court decisions yet to give a clear picture how the full intention of Congress is to be interpreted by the courts.

In ruling an operator with the three foregoing qualifications was not a bona fide jobber and not therefore entitled to a substantially lower price than service station operators, the commission issued an order against Standard to "cease and desist" from doing certain things. It still isn't clear whether the commission misunderstands the petroleum industry, whether it was careless in its analysis of facts, or whether it is attempting to force a philosophy of marketing on the industry contrary to anything heretofore used.

The industry wants to learn just what the situation may be. It seems almost obvious the case will find its way into the courts, and there will be no general attempt to observe the admonishments of the commission until the courts have had an opportunity of looking at the case.

Before considering the facts in the case before the commission, facts which are unfortunately not clearly and completely stated, it is important to understand the provisions of the law under which the proceeding was conducted.

The applicable provision of the Robinson-Patman Act prohibits discriminations in price between different purchasers of commodities of like grade and quality where the purchases are made for use, consumption or resale, and where such discrimination may have any one of three separate and distinct effects.

There is nothing wrong under the law in charging one customer one price and another customer a different price unless the transaction is in interstate commerce or unless its effect (1) is to substantially lessen competition, (2) tends to create a monopoly in any line of commerce, or (3) tends to injure, destroy, or prevent competition with either the person who grants or who knowingly receives the benefit of the discrimination, or with customers of either of them.

It should be noted it is not necessary the discrimination in price between customers have all three illegal effects listed. Only one such effect need be shown to prove violation.

An affirmative provision of the law says differences in selling prices which make only due allowance for differences in the cost of manufacture, sale, or delivery resulting from differing methods or quantities in which commodities are sold, are correct and proper.

Four customers of Standard were involved in the proceeding. Deliveries to those customers were made either by railroad tank car or by transport truck, the latter form of transportation seeming to have been almost exclusively used since 1940.

Three customers sold substantial portions of the gasoline they bought from Standard direct to the public through their own retail service stations, disposing of the balance to other service station operators; the fourth customer sold only to the public direct through its own service stations.

The similarity seems to end there. The FTC didn't point out which characteristic of the customers really caused

OPA Investigators Checking Indiana Standard's Books

CHICAGO—OPA investigators are now checking the books of Standard Oil Co. (Indiana) at 25 sales division points in 15 states. Effort is being made, said OPA, to close the "open end" feature of the suit now in Federal court by filing specific charges for full amount of alleged price violations.

them to amount to the same thing as service station operators except to the extent it castigates Standard for not restricting those customers to selling exclusively at wholesale, and by pointing out they all sold at least some portion of their material at retail through their own service stations.

Made No Formula

The commission did not lay down a formula as to what constitutes a jobber or under what precise circumstances an operator would be either a jobber of a service station operator.

The usual difference between price charged to jobbers and to service stations by Standard was 1½c. The commission, in its order, said Standard could make differences in prices between different dealers if the difference didn't amount to more than ½c, provided such a price differential does not "lessen, injure, or destroy competition."

Outside of that concession, which is unfortunately in the broad legal terminology and so vague as to be of little use as a guide to a selling company, the commission ordered Standard to cease and desist from selling gasoline of like grade and quality to competing purchasers at different prices, from discriminating in prices and from otherwise discriminating between customers under circumstances similar to those in Paragraph Four of its findings of fact.

That Paragraph Four is a "dilly" insofar as trying to find out where the limits may be is concerned. Boiled down into a few words it says Standard discriminated in price by selling its gasoline for resale direct to the purchasing public to four operators at prices which were substantially lower than the prices charged to its other retailer purchasers for gasoline of the same grade and quality.

The paragraph goes on to relate each of the four purchasers refered to has owned or operated one or more gasoline stations where Standard's gasoline has been resold at retail to consumers in competition with other retailers of the same grade who purchased the same from Standard or from others.

It concludes with a recitation of the fact that the price concession allowed these four customers was 1½c below the tank-wagon price.

It's impossible to tell whether the Commission is attempting to be a Sir Galahad and clean up a bad price situation in the Detroit area, or whether it is attempting to set a pattern for the industry generally.

That it may be thinking in terms of cleaning up the Detroit market is indicated from the statement that Standard didn't restrict these tank car buyers to reselling exclusively at wholesale, and by recitation of the cut prices and discount deals which some of the four operators used at various times.

It would be very apparent to the industry, if not to the FTC, that the Department of Justice would be interested if operators in the petroleum industry attempted either to restrict the persons to whom their customers could resell or the prices at which sales could be made.

It does seem clear from the decision that the refiner who sells only to those who operate bulk plants, and who charge all the same price, would have no difficulties with the commission.

It seems equally clear the refiner who sells to service station operators and to bulk plant operators in the same community would come under the prohibitions set forth by the commission because the commission orders Standard to refrain from "allowing a lower price to any dealer, jobber, or wholesaler on gasoline sold by such dealer, jobber, or wholesaler at retail, than the price which" is collected from retailer customers who "compete in the sale and distribution of such gasoline with such dealers, jobbers, or wholesalers in their retailing activity".

Order Goes Further

But the order goes even further, by saying such price discriminations are also prohibited where the favored customer resells the gasoline to any of its retailer customers at less than Standard's posted tank wagon price for its retailer customers.

It isn't clear how any supplier could give a discount to a jobber under a contract which would provide for that jobber respecting the supplier's tank-wagon market for sales to dealers, and hope to avoid trouble with the Department of Justice, and possibly with the Federal Trade Commission itself which has interested itself in so-called unfair practices in commerce for many years.

There's nothing at all in the order to indicate what position the commission would take in a situation where a supplier sold only to jobbers in one marketing area and only to service station operators in another, at differing prices. The question is not discussed; on the other hand, there is nothing to lead one to believe that the commission's position would be any different in this case than it is in the case of the supplier furnishing to both jobbers and service station operators in the same marketing area.

Citron-Kolb Oil Co., one of the alleged favored customers, had been classified as a jobber since 1928. During that time it operated as many as eight

(Continued on p 66)

Mich. Retail Dealers Assn. Head Views FTC's Indiana Order

Special to NPN

DETROIT—Rankin Peck, executive director of the Retail Gasoline Dealers Assn. of Michigan, Inc., last week ventured the opinion that the FTC order to Indiana Standard is directed at "the evil" of price discrimination.

In a statement to NPN, Mr. Peck had this to say:

"In regard to the Federal Trade Commission's order to Indiana Standard relative to price discrimination in this area, I believe that this decision was directed at the precise evil at which the Robinson Patman Act of Congress was directed. That evil is the type of price discrimination that invites destructive competition. Destructive competition is beginning to be understood as a threat to our business economy, and the whole nation has the stake in its business economy. If anyone doubts this, he needs only to look at what is occupying the minds of our people in Washington.

"We doubt if any man was ever restrained from such practices except against his will. But such restraints are for the benefit of the public. Furthermore, the population is constantly driven, in self-defense, to catalog new offenses against its body.

"Of such is the practice against which the Robinson-Patman law is directed. And such is the character of the thing—really a type of germ—which it seeks to control, that some people see it and some do not. In other words, it is not easy to see, but it is there—and it is just as dangerous.

"This nation has a stake in its small businesses, a stake that it recognizes today as much vaster than it ever conceived it to be a few years ago. But the small businesses cannot thrive if they are constantly being cut down in their prime—anymore than a population can that is poisoned with malaria germs. And the remedy is the same in both cases—get rid of the germs.

"If it is a fact that the small businesses of this country are its backbone—and this we are coming to understand to be true—then under the American system, we cannot hold out to these little enterprises the promise of a modest success if they strive energetically and honestly. Then when they have invested years of their lives and most of their little substances in trying to meet the conditions of that promise, only to find in the end that we do not carry out our part of the promise. Congress, in the Robinson-Patman Act, simply said that this nation will live up to those promises.

"Who can find fault with this in America, except those who find it hard to do business on as fair a basis as America wants it done?"

Major Petroleum Companies Fear FTC Rulings Against Standard of Indiana Set Precedents

NPN News Bureau

NEW YORK—Federal Trade Commission rulings against Standard Oil Co. of Indiana constitute the most important decision yet handed down under the Robinson-Patman Act and may ultimately affect the entire structure of oil marketing in the United States, in the virtually unanimous opinion of major petroleum companies here.

Legal authorities of several major companies admitted they were staggered by FTC finding Indiana Standard had impaired competition by meeting cut prices.

Sales executives foresaw no immediate change in marketing policies on the East Coast as a result of the decision, but said if it is sustained it will mean eventually a supplier must quote one price to all customers, except for sharply-defined classifications like jobbers, wholesalers and retailers.

The chief attorney for one major said in his opinion the commission erred on almost every point "if there is anything left of precedent and if the old rule still holds words should be taken in their ordinary significance unless a statute clearly requires otherwise.

"However, we are painfully aware that the world is a carousel and that yesterday's orthodoxy is today's heresy."

This same attorney's advice to manufacturing marketers was neither to follow the case nor ignore it. He pointed out to follow the ruling prior to judicial review would require disruption of business when there is a fair chance the Commission may be reversed on one or more points, and yet at the same time he said close attention should be given the case because of the possibility FTC may be upheld.

Appeal Expected

It is generally expected Standard will appeal to the Sixth Circuit Court of Appeals, and that if the Commission is sustained in that tribunal the case will be taken to the U. S. Supreme Court. If the Supreme Court upheld the FTC findings, there is little doubt that every major in the country would revise its marketing practices to conform to the new interpretation of the law.

A possible alternate legal procedure is that a similar case might arise in another area. The Sixth Circuit Court's jurisdiction covers Michigan, Ohio, Kentucky and Tennessee. If the same Commission decision were brought before another circuit court, and that court ruled contrary to the Sixth Circuit, the case would automatically go to the U. S. Supreme Court.

The sales manager and a vice president of one major oil company with headquarters here said the Standard case stems from the "evil of having a distributor in the territory in which the major company operates itself." He said there is a strong feeling in the industry that this in itself is an undesirable practice, since "in the long run it will produce only confusion."

He added that it has been used "as a device for getting at classes of business the supplier could not otherwise obtain."

This same executive saw no immediate threat to general existing marketing practices in the FTC order. He noted it is directed only at one company and others may continue past ways with impunity.

"This case," he said, "has been four years in the mill. The FTC might not act again unless there was clear evidence interstate commerce is involved. In any event, all this legal procedure takes time, and unless formal complaints arise, the Standard ruling won't affect companies operating in the East."

Subject to Review

All of the men interviewed asked their names and company affiliations be withheld, on the ground that the entire matter is still subject to juridical review and hence is not a proper subject for unguarded comment.

The problem posed by the case, said one company's counsel, "is essentially one arising in areas of dual distribution; i.e., where a refiner sells directly to retailers and also to jobbers who sell to retailers or who retail themselves in the same area. In short, there is no dual distribution, no problem under this case."

This attorney said there are two alternatives: either abandon dual distribution or continue it. In the latter election, he said, the best procedure in dealing with jobber-retailers and job-lot retailers is to try to sell at tank-wagon prices whatever portion of the purchases is resold at retail.

"When that plant fails, as it probably will because of competition—then meet the competition," he advised. "Still proceed on the theory that meeting competition is a good defense. We know if we do not sell at jobber prices everything the three classes of jobbers buy, they will buy at such prices from other refiners who are not involved in dual distribution. But," he added, significantly, "be sure to get proof of the competition being met and get proof before meeting it."

This last suggestion contains the crux of the entire problem, according to legal advisers of other majors, who remarked if the commission's ruling is upheld, the only practical way to get satisfactory proof of competition is to determine specific costs of delivery of product to *each* customer. This, it was agreed, is an almost impossible task.

"If Standard cannot sustain its contentions in the courts," one company lawyer said, "it will be almost impossible for any company to justify a price differential unless it can show a difference in cost as between two buyers. That's a job all FTC experts themselves would find it hard to do.

"The big point in the commission findings was the throwing out of the defense of 'meeting competition.' Their theory now is this is not an absolute defense, it's just a rule of evidence. Every oil company for years has been relying on the principle of the right to meet competition as the chief defense. Now that's out the window."

Implied Justification

The FTC implied, according to experts here, that if a jobber is engaged *entirely* in wholesale distribution there is justification for a price differential.

Company attorneys wryly remarked they themselves were unable to interpret many of the specific points made by the commission in its findings. Nevertheless, they discussed some of the most disputed paragraphs:

Paragraph Three, in which the commission apparently differentiated between "tank trucks" and "transport trucks." It seemed to be agreed under this ruling, if a major gave a price differential to a company, it would have to justify the cost differential to each account, distinguished by delivery in "tank-wagon," "tank truck" or "transport truck". That, as has been noted earlier, is next to impossible. The commission itself did not definitely fix classifications. One attorney said in the future FTC is likely to go back to the phrase in the Robinson-Patman Act: "due allowance for differences in costs of sale and delivery resulting from the differing methods and quantities sold." The commission is likely to tell the companies all facts must be considered, and they must show cost of sale and delivery to *each* dealer.

Paragraph Five, in which the commission several times mentions "classifications" as jobber, wholesaler, etc. Company attorneys believe this section of the decision is vague in language, but that the implication is the Commission will in the future recognize such accepted classifications as consumer, retailer and jobber. Whether they will take in such groups as "peddlers" is one of those so-called "moot points." An old decision (the Mennen case) under the Clayton Act, which preceded the Robinson-Patman Act, recognized the jobber classification as distinguished from the retailer. But how far the commission would go under the Patman Act no one can guess. The yardstick would seem to be competition.

Are two buyers from one supplier competing?

Certainly no committee or association could set up arbitrary classifications of jobbers, wholesalers, retailers, etc. Should they attempt to do so, the lawyers agree, those members of the industry who participated would immediately lay themselves open to prosecution for violation of the Sherman Act.

The FTC decision, it appears here, means that the buyer must be 100% a wholesaler to be entitled to the benefits of price-cutting, unless the cut is made to all customers alike. However, the major cannot put that provision into his contract with the buyer, for if he did so, he would be "restricting the sale of his product."

Then the question arises as to how the supplier can police the persons or companies who take his product, to be sure that they do not themselves re-sell at a cut price. Here legal opinion leans to the belief that it is entirely a question of the supplier's knowledge. If he acts in good faith and believes he is selling to a wholesaler he may reduce prices in individual cases. But if the supplier knows that his customer is even in part a retailer, he cannot give a wholesale price.

Paragraph Nine, in which FTC insists on exact and accurate cost separation. Company attorneys are positive FTC would not reveal, even upon inquiry, what cost system must be established. The text of the ruling itself, however, would seem to indicate that the supplier must determine the costs of sale and delivery to *each* buyer, and may even have to fix exact costs for each service station, if he wishes to cover the rental angle. Again, that's an impossible task.

One of the most interesting and at the same time most involved portions of the commission order was that in which it said (1) to the extent a jobber sold at retail he had to pay tank-wagon prices and (2) when Standard sold at less than tank-wagon prices to a jobber for resale to retailers, it could do so only if the jobber did not resell at less than Standard's tank-wagon price.

As one attorney put it:

"Bearing in mind few jobbers are strict jobbers and practically all do some retailing, speculate on what will happen to jobbers who have invested in bulk plants and trucks. The commission may have difficulty explaining to an appellate court how it justified not giving Standard an opportunity to allow jobber-retailers and job-lot retailers a differential reflecting the savings to Standard in selling these bulk operators as compared with selling to single stations. Are these jobbers who sell at retail to go out of such business or abandon their bulk plants and trucks?"

The second prohibition again brings up the policing problem. The attorney asked, in that connection:

"Can a refiner safely sell a jobber under such conditions? Hardly. Shall he refuse to sell to all jobbers? If all refiners do this and do their own jobbing, what will happen to the jobbers? Perhaps to play safe, refiners will abandon their own jobbing and leave everything to jobbers. That would be fine for jobbers, until it is realized that most jobbers also retail."

The impasse was summed up this way by another company representative:

"The Federal Trade Commission has made a notable contribution — not to the law but to lawyers."

Oil Equipment Still A Trickle Considering Industry's Needs

NPN News Bureau

CLEVELAND—The flow of new oil marketing equipment from manufacturers is still only a trickle—and as far as the manufacturers are concerned, strictly non-profitable. A telephone survey of manufacturers this week shows that their supply, materials and manpower situation has not improved in recent weeks from the unhappy conditions reported by NPN in the Sept. 19 (page 5) issue.

Grey iron castings, fractional horsepower motors, steel, belts, dials, and even glass for visigauges are chief bottlenecks in full production of oil marketing equipment now. One manufacturer reports it looks like gasoline pump hose may be next "short item". He could not say if this reflected labor conditions in rubber plants.

In addition to these shortages in materials, plants in critical labor areas are short of skilled labor. The manpower released from war plants is available in some places but does not offer the kind of skills required by equipment manufacturers.

The manufacturers are keeping expediters in the field to accelerate the movement of parts and materials. One manufacturer sent its sales force into the field to buy belts from automotive stores to complete assembly of gasoline dispensing pumps. Another manufacturer picked up its patterns, packed them in the back end of a car and went up and down highways trying to find a foundry that would make castings that were urgently needed.

None of the plants are running at 100% of peacetime capacity and not one will be shipping equipment in peacetime volume until some time in 1946. One manufacturer, able to assemble and ship only 30 gasoline dispensing pumps during the past three weeks, said their plant might reach 50% of peacetime deliveries by the end of the year.

Suppliers to the equipment manufacturers are accepting orders on a "when, as, and if" delivery. If they give schedules their own materials and labor problems keep them from making good on the dates.

The manufacturers are anxious to achieve full volume so they can reach a break-even point in their operations. When they can finish only four or five gasoline dispensing pumps in a day—and the plant is filling up with partly assembled equipment lacking a few parts to make delivery to waiting customers—and expediters in the field are running up the overhead—there isn't much of a chance to show a profit to the stockholders.

Manufacturers are making and assembling equipment as rapidly as possible in spite of the fact that all equipment, except for gasoline dispensing pumps, are still held under prewar ceiling prices. All are trying to allocate meager production to satisfy the most customers.

One company has set a limit of three gasoline pumps on one delivery to any customer even though the oil company may have 50 or 100 on order. Another manufacturer is making prior allocation to smaller independent oil jobbers to spread his supply over as many customers as possible.

One equipment company said when it got cancellations on war orders in the morning—effective at noon the same day—it was able to set up a peacetime manufacturing line in order by two o'clock that afternoon. But ready or not, this company's production line cannot make complete units for delivery to the oil industry without essential motors, castings, belts, switches, copper tubing, or any one of 800 or so parts that go into a modern computing gasoline dispensing pump.

Running production at a loss, trying to satisfy oil industry needs in the face of shortages, and convincing customers that everyone is treated on the most equitable basis does not make the oil equipment manufacturer's lot happy. The headaches created by this situation may be increasing the aspirin market in the equipment field to the point where an oil equipment man may qualify for the carload price.

Anti-Freeze Shortage To Continue Several Months

NPN News Bureau

WASHINGTON—Army demands for "permanent type" anti-freeze are likely to continue high for several months to come, and there will be little if any easing of supply to meet needs of civilian motorists, according to Civilian Production Administration officials.

They added that present civilian anti-freeze supply of "permanent" type now averages about 9,500,000 gals. per month—roughly half of prewar normal supply—and said end of the war brought little help to this situation in way of army cutbacks, which have totaled only 1,500,000 gals. since V-J day.

'Open Door' Policy of District Two Gave Everyone in the Oil Industry a Fair Deal

Resolutions of thanks for the co-operation of the oil papers with the work of the Petroleum Industry Committees of District 2, PAW at Chicago, have been adopted by the General Committee of District 2 under the chairmanship of Otto D. Donnell, president of the Ohio Oil Co., Findlay, O.

On behalf of NPN we accept the thanks and reciprocate by giving to Chairman Donnell and most of his committees and their members and to former Deputy PAW Administrator for Dist. 2, W. W. Vandeveer and his associates, our thanks for their co-operation in publicizing their efforts on behalf of the industry during the war. These particular men in District 2 showed a keen appreciation of the fact that the information they created, the news of their activities, belonged to the entire oil industry and was not their personal property. These men realized that they represented every one in the oil industry and not just themselves and that as industry representatives they should account to the entire industry promptly and fully as to what they did in their official positions.

These men in District 2 were under the same rather ambiguous directions from Washington as to how to "clear" information as were all other districts but these men did not hesitate to interpret that in the interest of the entire oil industry. We never agreed with these Washington directions as they were often interpreted and we never hesitated to disregard them and to cause others to disregard them, short, of course, of disclosing actual military information. As to military secrets, we were under a direct responsibility to the Chief of Press Censors, just as great if not greater than any responsibility of any members of PAW committees or staffs, and we never had any difficulties agreeing with the chief censor as to what should and should not be printed.

Difficulty of Relationships Within Industry Due to Policy of Secrecy

But we did disagree with the opinions of some committees and committee members and some people at Washington in their narrow interpretation of their responsibility to the oil industry. And we never hesitated to exercise our own judgement as against their faulty judgement, so we believed, in the interest of the oil men who were not present at meetings and who would not be informed as to what went on at these meetings even though their competitors benefited from this allegedly secret information that in fact belonged to every man in the oil industry.

Much of the difficulty of relationships within the oil industry is the outgrowth of the policy of secrecy which has governed in the past the major companies especially. That policy has been discarded by some of the majors completely and discarded in part at least by all. Some majors are at the other extreme in frank talking to the industry both publicly and individually.

It was unfortunate for the industry and for the major companies that the coming of the war aroused some of the old instincts for secrecy and further aroused in the minds of some men, man's natural desire, when given the authority, to be the judge of what shall be told the other man, particularly his smaller competitor. A more open door policy by every one connected with the war work would have greatly furthered general industrial relations.

Out in the middle west, the home of perhaps 75% of the present Independent oil movement, it was fortunate that men like Otto Donnell and "Van" Vandeveer were in charge and that they kept their doors open to the members of the industry who were not on the PAW committees so that the industry felt it really knew what was going on. Perhaps they did not always open their doors strictly according to the rules and regulations from Washington, perhaps at times they just forgot there were rules. But however they did it, the fact remains that the industry in the west, we believe, feels that it sat in on the war work of these committees almost as much as if they were present in person. Had it been otherwise there is little question that war or no war, there would have been much inter-industry strife.

Resolution to the Oil Press

NPN appreciates opportunity these gentlemen at Chicago gave it—NPN—to co-operate with them that the industry might be fully informed of their war work. Following is the resolution to the oil press by Mr. Donnell's General Committee.

WHEREAS, the Petroleum Industry Committees for District Two were appointed by the Petroleum Administrator for War and charged with the responsibility of assisting the Administrator in coordinating the operations of the Petroleum Industry through the medium of surveys and examinations of the Petroleum Industry in the District and making recommendations to the Petroleum Administrator for War regarding operating practices and policies within the Industry which might contribute to the successful prosecution of the war; and

WHEREAS, the Committees have from time to time called upon the various newspapers and trade journals in the District to publicize their activities and recommendations in order that the Petroleum Industry and the public generally might be fully informed of the type of task they were attempting to perform; and

WHEREAS, the newspapers and trade journals have performed an outstanding service during the war period in disseminating much important data and information for the members of the Industry and the Public in District Two;

NOW, THEREFORE, BE IT RESOLVED, That the Petroleum Industry Committees for District Two do hereby express sincere appreciation for the manifested cooperation and helpfulness on the part of the newspapers and trade journals; and

BE IT FURTHER RESOLVED, That the Secretary of the General Committee for District Two be hereby directed to inscribe this resolution upon the minutes of this meeting, making copies thereof available to representatives of the press.

READERS' comments and opinions will be much appreciated by Warren C. Platt, NPN's Editor and Publisher, Penton Building, Cleveland 13, Ohio.

Knight Charges Truman Broke Oil Strike; Urges Speedy Action to Settle Pay Issue

O.W.I.U. Head Levels Tirade at Administration in Full-Page Advertisement; Raps Oil Plant Seizures by the Navy

NPN News Bureau

WASHINGTON — Delegates to the national labor-management conference seeking "peace at home," include one segment—C.I.O—launching on the quest with some explosive equipment.

Although not seated in the assembly, O. A. Knight, president of the Oil Workers International Union, had found a way to bring to its attention the charge that a national administration had broken a strike for the first time since the Harding era in taking over oil properties. Accompanying the accusation was an appeal "to set up immediately machinery by which the wage controversy in the oil industry may be resolved."

And C.I.O. President Philip Murray had split the conferees on the question of the scope of their agenda, insisting that the matter of industrial wages was the real subject of collective bargaining which President Truman had urged that the conference implement.

Warning by William Green

Before Mr. Murray spoke, William Green, president of the A. F. of L., had warned that inclusion of the wage issue "would make failure of this conference a foregone conclusion."

The President's committee of principals planned the agenda not to include this issue, saying, however, "there is no thought of limiting the subjects or discussions at the conference."

In contrast to the aggressively vocal C.I.O., the Navy had quietly freed WLB to resume processing of all oil company cases pending before it in which general wage issues are not involved but which relate to plants controlled by Navy in the wage dispute.

Request for WLB action by the Navy Department had released the board from freezing provisions of the Smith-Connally Act under which President Truman had ordered seizure of strike-bound refineries and pipelines. Either Navy or union petition was necessary if the cases were not to have lain dormant during government control of the properties.

A spokesman pointed out that, inasmuch as the Navy's administration of the plants actually is only nominal, the service branch saw no reason that the board should not proceed with the cases as if the plants were operating under normal circumstances.

He said also the Navy's district supervisory officers had been instructed that all WLB orders dated before the seizure were to be acted upon wherever they involved seized plants.

Mr. Knight used a full-page newspaper advertisement to spread before the conferees the oil workers' contentions in their wage demands and to assail President Truman for alleged inconsistency in word and deed.

Captioning the advertisement "An Open Letter to President Truman . . . we'd like to practice what you preach," Mr. Knight declared "The Navy should never have been submitted to the embarrassment of policing labor" and asked . . . "in the spirit of your admirable (wage-price policy) address, let us get back to the free operation of our competitive system through free and fair collective bargaining."

Text of Advertisement

Complete text of the advertisement follows:

The Oil Workers International Union-C.I.O. applauds your message to the American people of Oct. 30, and respectfully suggest that its principles be applied in the current wage dispute in the petroleum industry. We stand ready and willing to practice what you preached when you said:

"I am convinced that we must get away as quickly as possible from government controls, and that we must get back to the free operation of our competitive system. Where wages are concerned, this means that we must get back to free and fair collective bargaining."

However, we find ourselves today, at the opening of the national labor-management conference, in a position without parallel in the history of labor relations. The oil companies have refused to bargain, either company-wide or nation-wide. They have rejected the arbitration proposed by your administration. Nevertheless, when the conferences initiated by your Department of Labor broke down, you thereupon by executive order seized certain key oil properties, broke the oil workers' strike and penalized that party in the controversy which had accepted in good faith your intervention in the oil wage dispute.

It is necessary to go back to the Harding administration to find the weight of the federal government being used to block an effort by workingmen to defend their standard of living. Attorney General Harry M. Daugherty in 1921 broke the strike of the railroad shopmen through a federal injunction. In 1894 President Cleveland broke the Pullman strike through the use of federal troops. The situation today differs only in that a war measure is used in peacetime instead of an injunction, and that the threat of armed force is brought to bear through the U. S. Navy instead of the U. S. Army. In the place of free collective bargaining untrammeled by government controls which you called for in your admirable speech, we have the curious spectacle of U. S. Navy officers governing labor relations in a key industry.

What Is the Wage Issue?

The wage issue in dispute between the Oil Workers International Union-C.I.O. and the industry is simple. Shall oil workers' earnings be maintained at their present level when the industry converts from the 48-hour week to 40 hours? Or shall they be slashed 30%? Or shall the union surrender unconditionally to the unilateral decision by a minority of companies, taken without consultation of any kind with the union, to cut earnings 15%? The union, in order to maintain take-home pay and thus preserve the purchasing power of its members, has asked for a 30% upward adjustment in pay rates, not in earnings, in order to maintain the status quo in oil wages.

National Prosperity at Stake

We believe that the preservation of the purchasing power of industrial workers is the key to our country's prosperity. With a 30% slash in earnings imposed on industrial workers, the nation's farmers will find their markets cut by that amount. The nation's business men will find that just that much less will be run up on their cash registers. The butcher, the baker and the candlestick maker will suffer equally with the industrial wage earner.

Maintenance of purchasing power is the essential factor in fulfilling America's national policy of full employment and prosperity. Wage cuts never yet have helped business. One wage cut breeds another. The results are seen in breadlines, WPB, Hoovervilles and veterans selling apples to those fortunate enough to have a nickel to spare. Our union, in urging the oil industry to reconvert as speedily as possible to the 40-hour week, is convinced that thereby tens of thousands of jobs can be opened up to our returning service men.

Can the Oil Industry Afford to Maintain Wages?

In your message to the people, you said that "there are several reasons why I believe that industry as a whole can afford substantial wage increases without price increases."

Permit us to point out why industry is in a unique position to maintain the purchasing power of its employes. Of all industries, none emerges from the war with greater

ability to maintain present corporate earnings and employes' earnings. The oil industry enjoys the lowest labor costs of any major industry. Less than 8 cts out of every oil dollar goes to meet the payroll, contrasted with labor costs as high as 50 prct in certain other industries. Last year Standard Oil of New Jersey earned a profit equivalent to $3,000 for each employe — an amount greater than was paid in wages to the average employe.

With earnings at an all-time high, with earned surplus accounts doubled in many cases by the bonanza profits of the war, and with profits continuing upward in the third quarter of 1945 — reflecting postwar trends — the oil industry is in the favorable position of being able to take the lead in demonstrating its confidence in the future. There is not the slightest reason why it should cut wages 30%, 15% or by any other figure.

The Trend Is Upward

"Standard Oil Co. of California reported the largest quarterly net income in more than a decade—$14,951,365 or $1.15 a share for the three months ended Sept. 30." —Chicago Journal of Commerce, Nov. 1, 1945.

Tide Water Associated Oil Co.—Net income $12,159,291 or $1.90 a share for the first nine months of 1945, against $10,798,453 or $1.69 a share for the same period of 1944.

Union Oil Co. of California—Net income $7,323,796, equal to $1.52 a common share after preferred for the first nine months of 1945, against $5,604,971 or $1.20 a share for the same period of 1944.

Phillips Petroleum Co.—Net income $18,895,956, equal to $3.84 a share for the first nine months of 1945, against $14,997,362 or $3.05 a share for the same period of 1944.

Shell Union Oil Corp.—Net income $25,586,447, equal to $1.90 a share for the first nine months of 1945, against $22,538,062 or $1.68 for the same period of 1944.

Let's Return to the American Way

In your message you said: "We must get away as quickly as possible from government controls." With that statement the Oil Workers International Union is in complete agreement. With your action in placing U. S. Navy officers in charge of labor relations in certain key plants of the oil industry we are in complete disagreement. With the highest regard for the fine men wearing the American uniform, we nevertheless submit that they are not qualified either by training or temperament to handle the labor problems of the oil industry. We realize full well that they themselves did not ask for this assignment and wish to be relieved as quickly as possible, both because they believe in the traditional American separation of military and civilian functions, and because they realize that any effort to use the military in such a situation jeopardizes the public good will essential to the Navy's welfare.

The Navy should never have been submitted to the embarrassment of policing labor. Spokesmen for the oil industry admit publicly that there was not the slightest danger of the Navy running short of fuel oil or of the military needs of the nation being affected as a result of the recent oil strike.

Undoubtedly you had in mind the oil industry wage dispute when you included these remarks in your speech of Oct. 30. The oil industry had refused to bargain, either by companies or nationally. They had rejected all efforts of a special U. S. Labor Department conciliation panel to enter into collective bargaining with the union in conferences held in Chicago and later transferred to Washington. Finally they rejected arbitration proposed by Secretary of Labor Schwellenbach.

We feel that by seizing key plants of the oil industry, you penalized not the party which had defied governmental efforts for conciliation and arbitration, but the party which had accepted your intervention in good faith.

We feel that a grievous wrong was done to the oil workers of this nation. We appeal to you now, Mr. President, as your historic labor-management conference opens in Washington, to set up immediately machinery by which the wage controversy in the oil industry may be resolved. Manifestly it is unfair to the workers of the oil industry to deny them the right of economic action in defense of their living standards, to place them under military control, and then to fail to remove the conditions which led to Navy seizure.

In the spirit of your admirable address, let us "get back to the free operation of our competitive system" through "free and fair collective bargaining."

1944

Company	Dividends	Net Income	Surplus
Standard Oil of New Jersey	$68,000,000	$155,000,000	$684,000,000
Gulf Oil	18,000,000	42,000,000	164,000,000
Atlantic	4,500,000	14,700,000	107,900,000
Phillips	9,800,000	20,900,000	68,600,000
Pure Oil	7,800,000	16,300,000	48,700,000
Standard Oil of California	26,000,000	43,400,000	94,100,000
Texas Co.	28,000,000	54,500,000	215,000,000
Union Oil	4,600,000	8,900,000	28,500,000
Tide Water	8,500,000	19,500,000	61,200,000
Shell	20,200,000	28,100,000	36,400,000
Standard Oil (Indiana)	22,900,000	50,500,000	263,600,000
Socony	23,300,000	62,300,000	123,200,000
Sinclair	9,500,000	27,300,000	65,800,000
Standard Oil (Ohio)	3,000,000	6,700,000	36,100,000
Totals	$254,100,000	$550,100,000	$2,697,600,000

1939

Company	Dividends	Net Income	Surplus
Standard Oil of New Jersey	$33,000,000	$89,000,000	$513,000,000
Gulf Oil	9,000,000	15,000,000	94,000,000
Atlantic	3,100,000	5,000,000	67,900,000
Phillips	8,800,000	9,800,000	38,300,000
Pure Oil	4,700,000	8,200,000	22,500,000
Standard Oil of California	14,300,000	17,800,000	67,300,000
Texas Co.	21,700,000	32,800,000	130,000,000
Union Oil	6,000,000	5,800,000	18,600,000
Tide Water	7,200,000	9,900,000	33,000,000
Shell	8,300,000	11,800,000	16,800,000
Standard Oil (Indiana)	15,200,000	27,700,000	148,400,000
Socony	15,600,000	34,400,000	125,800,000
Sinclair	10,900,000	7,500,000	18,100,000
Standard Oil (Ohio)	1,700,000	5,600,000	18,800,000
Totals	$207,500,000	$280,300,000	$1,312,500,000

Tire Production Delayed By Production Slowdown

NPN News Bureau

WASHINGTON—OPA warned this week a "substantial increase in production" will be necessary to permit ending tire rationing within next few months, since passenger tire applications now exceed supplies by nearly 1,000,000 tires.

Max McCullough, OPA Deputy Administrator for rationing, said backlogs of unfilled applications skyrocketed after lifting of gasoline rationing and had reached total estimated at more than 875,000 at end of September.

SEC to Hear Red Bank Case

Special to NPN

PHILADELPHIA—Securities and Exchange Commission will hear additional evidence on financial affairs of Red Bank Oil Co.'s registration statement filed some months ago in further hearings this week.

Meanwhile SEC again suspended N. Y. curb trading in the firm's $1 par value common as of Nov. 5, the suspension to last ten days. This severed proceedings to determine whether it could be suspended or withdrawn.

Washington—By Raymond E. Bjorkback

Sun Oil Shows Enterprise in Announcing Expansion and Rehabilitation Plans

WASHINGTON — By not being mousey about a new mousetrap last week, Sun Oil Co. struck a timely blow for the entire industry. And in the doing, the mousetrap got a better introduction—one calculated to help make Sunoco driveways busier paths.

Mr. Bjorkback

Gathering more than a score of eastern and midwestern newsmen for a conference in Philadelphia to announce its new motor gasoline and a $20,000,000 marketing expansion and rehabilitation program, Sun took some pains to make the announcement interesting. (See page 68.)

President J. Howard Pew, himself, faced the press for the first time in his career. Greeting his guests, he made clear some of the advantages to the public of having industry unregimented and American ingenuity unfettered.

Arthur E. Pew, Jr., vice president in charge of manufacturing and research, recounted how ingenuity, enterprise and capital in the oil industry helped give our armed forces the margin of victory in war—and now were passing on to the public the benefits of improved processes and products.

Then Samuel B. Eckert, vice president in charge of marketing, reported Sun would be creating 2,000 new jobs by spending still more money in a bid for more business.

Mr. Arthur Pew not only had the skill but took the trouble to handle a subject highly encumbered with the technical in such a manner that the newsman could feel he was getting a liberal education in refining processes at the same time that he was being given a look behind the scenes of a stimulating wartime adventure.

Sun's officers showed an awareness of the fact that a newsman's time is wasted on an assignment unless he is learning something he can use. They had a story for their guests before they invited them to listen. They lent it authoritativeness and interest by telling it themselves. They made sure it was fully and clearly told.

Their thoroughness extended to the distribution of written material covering all that they said, and then some. They took the opportunity to include a history of the company. While that wasn't expected to be of immediate use to the men receiving it, its future value was obvious.

Similarly, it wasn't likely that very many of the newsmen present were going to dash out and write the story of how the oil industry helped win the war, news of the moment being the reporter's first responsibility. But if none of them ever writes that story as such, each at least will be better able to evaluate—say—the suggestion in a labor dispute that the oil companies' chief role in the war was that of the profit taker, and that their profits are lying idle for the plucking.

The day's program was concluded with a tour of Sun's Marcus Hook refinery. Here, again, was improved the newsman's insight into the burdens management bears, the responsibilities to labor, and to the consuming public generally, which it discharges.

Sun's officers could have saved themselves time and money by simply issuing a press release on Dynafuel and their marketing program, and unveiling, as they did, a model of their new service station.

But by extending themselves enough to be democratic as well as realistic, they did immeasurably more than they could have done otherwise not only for Sun, but for the industry as a whole. And for labor and its neighbor.

One need only have been among the newsmen that day to conclude that the industry generally might well take the veil—off.

Atlantic Coast—By Frank P. S. Glassey

Vision World Oil Demand, Excluding Russia and U. S., as Doubled by 1965

NEW YORK—An extremely interesting long-range forecast of world petroleum consumption, made here recently by Gordon H. Michler, area adviser of Standard Oil Co. (N. J.) for northern Europe, envisages world demand for crude and products in 1965—excluding Russia and the United States — at approximately 3,900,000 b/d, or about double 1938 consumption. Over a shorter period, however. Mr. Michler expects a comparable 1946 demand of about 1,975,700 b/d, or only about 1% above the prewar level.

Mr. Glassey

These forecasts were made in connection with estimates of future tanker tonnage. Admittedly—particularly when extended over the longer period—they are subject to much possible error and involve certain assumptions which may or may not materialize. But they are undoubtedly as carefully calculated as is possible under present circumstances, and will form some basis for operational planning by one of the world's largest oil companies.

Discussing the year 1947, (and Mr. Michler believes demand in 1946 will be approximately the same), he said:

"Excluding Russia, which represents 795,700 b/d in 1947—a 42% increase over 1938—the total 1947 foreign demand is estimated at 1,975,700 b/d or only 1% over the 1938 prewar figure."

He broke down this foreign demand into main consuming areas as follows:

	B/D	
Western Hemisphere excluding U. S.	678,100	39% increase
Europe, excluding Russia	689,300	26% increase
Asia	270,700	5% increase
Africa	173,600	36% increase
Oceania	164,000	32% increase

"Therefore," Mr. Michler pointed out, "we see that, whereas the Western Hemisphere, excluding the United States, is expected to increase by 39% in 1947—and increase is likewise reflected in the smaller consuming areas of Africa and Oceania—the consuming areas affected by war damage and dislocation. Europe and Asia, are expected to absorb at less than the prewar rate—26% less in the case of Europe, and 5% less in the case of Asia.

"Another interesting factor is that Europe, which before the war required substantially more than Canada and Latin America, will be able to absorb in 1947 an only slightly larger amount."

By 1950, the survey indicated, total foreign demand, excluding Russia, should approximate 2,471,700 b/d, or 25% above 1946 and 1947. This, Mr. Michler said, "clearly indicates an increasing demand for sea-going transportation during this period."

Mr. Michler added that when attempts are made to project the estimates of 1965 "we get more than ever into the realm of crystal gazing in which one prophet's word is no better, or worse, than another's."

Nevertheless he said that, on the basis of projected trends, "total foreign demand for petroleum crude and products, excluding Russia, by 1965 is estimated at approximately 3,900,000 b/d or about double the 1938 quantity. By way of comparison, domestic demand for crude and products within the United States in 1938 was 3,115,000 b/d. In other words, the foreign demand should, by 1965, out-

strip the demand in our own country in 1938."

Applying his near-term forecast in terms of tankers, Mr. Michler said:

"As against a world tanker tonnage increase of from about 17,500,000 dead-weight tons prewar to, say, 25,000,000 dead-weight tons postwar—in terms of prewar carrying capacity—an increase of roughly 40 per cent in carrying capacity—the foreign demand for petroleum crude and products that would require such transportation will, in 1947, probably amount to only about 1% more than in 1938 but is estimated to increase by 1950 by 25%.

"These figures, of course, do not include any estimates for transportation requirements between U. S. ports, either coastwise from the U. S. Gulf to the North Atlantic, intercoastal from California to the East Coast, or possible imports from such sources as the Caribbean to U. S. ports.

"U. S. consumption requirements are, of course, considerably heavier than those in the foreign areas reviewed—for example, an estimated 4,395,000 b/d in 1947 or more than double the foreign requirement figure excluding Russia. This emphasizes the importance to tanker transportation of that part of these U. S. requirements that will require tanker movement."

* * *

Total European demand in the next couple of years for crude and all its products will, as Mr. Michler has said, undoubtedly be substantially less than prewar. But in the last few weeks certain European countries have been buying kerosine and fuel oil at Gulf Coast ports in steadily increasing quantities. In fact, export sales have been so large as to cause serious fears among fuel oil distributors here that there may be a shortage of those products for consumers in this area during the coming winter.

Some of the major companies in the Gulf region have been reported buying from independent refineries, thus eliminating the source of supply for independent marketers. Much of this product, chiefly kerosine, has been exported to Sweden, England and France, all of which are short of coal and other fuels.

The reason for the apparent discrimination in favor of European buyers as against domestic consumers, according to some of the local distributors, lies in the premium which OPA permits for export sales. This amounts in some cases to one-half cent a gallon on kerosine. As one New York fuel oil distributor put it:

"Europe is admittedly in a tough spot, but the American citizen should at least be on the same basis as a foreign citizen on price. We shouldn't allow foreigners to buy from under our noses when we know it may mean hardship at home this winter."

PIPELINES NPN Writers at Three Vital Points Discuss the Industry's problems-

Midwest—By Earl Lamm

2 Major Oil Firms Reported Ready to Shift Headquarters to Chicago

CHICAGO—Tidbit rumor of the week points a finger at two major oil companies and without naming them, says that they will soon announce removal of their New York headquarters offices to Chicago. There are many reasons why such a move would be advantageous if actually planned, and very few good reasons remain as to why it could not be done.

Mr. Lamm

Going further than here even, may be advisable.

The trend in almost everything is toward a breakdown of centralized control, and the ivory towers on Wall Street become less desirable. They are too cold and calculating for the closer human touch in the eyes of distant employes.

The industry raised early and insistent objections to handling all wartime operations from Washington and PAW set up five district offices "to get closer to the grass roots." PAW directors of those offices were given more and more authority with beneficial results until the need for regulation became unnecessary and cancellations began. The same thought should benefit industry when operating upon its own.

Most major oil companies and many of the smaller ones have set up various functional or operating committees somewhat on the PAW-industry plan, which meet daily, weekly or as necessity dictates. The chairman of the board, president or some other top company executive no longer takes unto himself all authority at least not without first consulting with the operating committees or others in the organization

To point up a few of the reasons for the rumored move of the two New York headquarters offices: The biggest single petroleum market in the world is the Midwest, and is so recognized by the industry. Chicago is headquarters for that market and is centrally located for nationwide travel in any manner. A big new airport is in the making and direct commercial plane flights to all parts of the world are planned. This would be of convenience to exporters and companies with foreign operations across the Pacific, in the Middle East, Europe, South America, Canada, and Alaska.

Mayor Edward J. Kelly is endeavoring to have Chicago named the home of United Nations Organization, and not without some possibility of success.

More locally, oil company executives have always been torn between two arguments—locate their manufacturing plants and office headquarters near their most important markets and pipeline or ship their crude; or locate them near the crude source and ship the products. Bureau of Mines statistics show what has been done with the refineries, for District 3 in the Southwest where about half of the country's crude oil is produced and which has a refining capacity of 1,700,000 b/d; District 2, the Middle West, 1,200,000 b/d and District 1, the East Coast, about 750,000 b/d in round figures.

The New York money market has been the controlling factor in location of most major oil companies headquarters in the past, but that is less and less necessary as oil companies and other industries have thoroughly established their financial responsibility. However, it happens that at this moment, billboards here are plastered with signs advertising the city as a financial center. So it appears that some big money feels at home here.

Talk has been prevalent for many months about relocation of industries in the East, particularly moves to the Middle West, South and Southwest in order to be near sources of raw materials. As for oil industry headquarters locations, the cry from the grass roots of the hinterlands becomes louder and louder. For instance, six out of 11 oil companies represented at the recent labor-management strike conferences in Chicago and Washington, have their headquarters in New York. They are having great difficulty in convincing O. A. Knight, president of the Oil Workers International Union, down at Fort Worth, that they can not pay more than 15% wage increase. Radical C.I.O. labor leaders do not care where the money comes from so long as their demands are met for exorbitant pay boosts. They undoubtedly have a feeling that if the billionaire oil companies do not have the ready cash, they can get it right there in Rockefeller Center or step over to Wall Street for it.

This is evidenced by the fact that on Oct. 23, Mr. Knight, quoting from Moody's Industrials for 1945, named 12 oil companies having grand total earned surpluses of $1,634,189,221. Eight of the 12 companies have their headquarters in New York. Oil companies other than

those with headquarters in New York, who had struck plants, are for the most part small or comparatively so—Wilshire Oil Co., Los Angeles, Aurora Gasoline Co., Detroit, small refiners in Texas, Phillips and even Pure Oil. They merely got caught in the jam.

It is highly noteworthy that Standard of New Jersey and Standard (Indiana), whose headquarters offices are located very close to their largest refineries, both have independent union employes, were not struck and are not now in the hands of the Navy. They have wages problems, yes.

The public relations department of Standard (Indiana) has moved into larger quarters on the 16th floor of their building at 910 South Michigan Blvd., Chicago. Franklin Courtney Ellis, formerly head of public information department, Eastern Kodak Co., Rochester, N. Y., has been named assistant to Public Relations Director Conger Reynolds.

It is even more significant to observe that none of the 10 refineries operated by Super-Co-ops are in Navy hands, and the co-ops do millions of dollars worth of oil business annually. Howard A. Cowden, president of Consumers Co-operative and an oil co-op leader, said a few days ago that none of the co-op refineries has had any labor difficulty and that none was in sight, although Oil Workers International Union (CIO) members operate them. It must be granted by private industry that the co-ops—even the super-duper ones—do live closer to the grass roots. The fact that the thousands of co-op members, especially farmers, which the co-ops claim, wield a political influence that perhaps Mr. Knight and his O.W.I.U. are afraid to tackle, does not alter the situation, except to make it stronger. Harmony between the co-ops and union labor apparently is increasing.

Concerning the changing attitude of major oil companies toward their employes, we cite a little story—one of those incidents that sticks in the mind. Some five years ago, an assistant department head was asked what he thought of the vice president, top executive officer at the Tulsa branch of the company.

"Don't know!" was the curt reply. "Never saw him. He doesn't come around, and probably uses a private elevator. I don't know what he looks like and would not recognize."

When covering the FTC natural gas hearing at Kansas City two months ago, we visited with a newspaper friend from Oklahoma covering the same beat. He inquired if we knew about the employes parties being given during recent months by major oil executives in Oklahoma—not company picnics—just friendly, get togethers with one department or small group at a time, no ballyhoo.

Is it surprising then that office buildings in New York or even Chicago acquire the aspects of ivory towers on the moon in the eyes of people who do not know their own local boss who works for years in the same building they do?

Sees Tremendous Surge Of Postwar Business For Petroleum Industry

NPN News Bureau

CLEVELAND — A high-competition, tremendously-expanding market for the petroleum industry lies just over the postwar horizon.

David Cunningham, assistant to the president of Tokheim Oil Tank and Pump Co., Fort Wayne, Ind. assured members of the Petroleum Club of Cleveland that these things are true despite "a new order of some kind" which seems to be in the making."

His address on "Where Do We Go From Here?" made at this week's noonday luncheon meeting of the club, was both a ringing defense of the American system of free enterprise and a denunciation of proposed controlled economy for this nation.

Stressing the opportunities in the expanding market of the postwar world, he forecast:

"Automobile replacement, installation of home heating units as a part of modernizing and constructing new homes, and advancement of private and commercial flying should result in an increased market for the oil industry."

He even hinted at sale of autos in service stations, asking:

". . . Is some lower cost distributor—such as dealer-owned filling stations, which are accustomed to make their living by selling quantities of gasoline at minute profits, the outlet which will sell the most (mass-produced automobiles) at the lowest prices?"

These conclusions came under the first of his "postwar factors," which dealt with competitive markets; other factors he discussed were restrictive controls, which he said were happily vanishing; full employment, under a system of full production rather than planned economy; taxation, based on stimulation of production; and better public relations with the consuming public.

"(Planned economy) . . . is something that won't work here in America," he said. "This is contrary to the fundamental truth that the source of prosperity is in increased production."

"Higher wages with shorter working hours will obviously increase costs and decrease purchasing power, all of which is inflationary, the very thing that we have endeavored to avoid."

"We'll Have Figures" Texaco Official Promises Union

Special to NPN

BEAUMONT, Tex.—"We'll have some facts and figures to give them."

This was the comment this week of B. H. Anglin of New York, Texaco's assistant to the general manager as O.W.I.U. representatives continued to hold the floor presenting their 52-40 case to Texas Co.

Mr. Anglin preferred not to discuss union concessions, if any, but admitted 52-40 was the main issue and the company is sticking to its 15% wage increase offer. Texas Co. representatives included R. G. Rankin.

NPN News Editor Hits The Skyways to Alaska

By Paul Wollstadt
NPN News Editor

OAKLAND, Calif.—National Petroleum News is hitting the skyways again. This time the destination is Alaska and the Aleutian Islands.

On July 19, 1944, Editor Warren C. Platt took off for Europe to cover the story of oil at war in that theater—a story told in 200,000 words cabled and airmailed to NPN readers during the nine months Editor Platt was a war correspondent in the E. T. O.

On April 12, 1945 Herbert A. Yocom, chief of NPN's Washington bureau, left the capital on a flight to the Pacific, where he wrote the story of oil in the war against Japan.

On Friday (Nov. 2) the writer of this article left Washington in a Navy plane with Lieut. Com. Walker J. Macfarlan and eight newspaper and magazine correspondents. We are bound for (weather permitting) Kodiak, Adak, Attu, Fairbanks, Point Barrow, Anchorage and Juneau. Seven other newspaper and magazine correspondents are scheduled to join use here in Oakland.

We expect to see the wartime installations of Naval Air Transport Service and to visualize commercial airline operations of the future over the Northern route to Asia.

We will be shown the Navy's other operating bases in Alaska and the Aleutians.

There will be a glimpse—and it may not be more than that—of the Navy's oil operations at Point Barrow, the northernmost point in Alaska. If weather allows the flight to Point Barrow, we will be the first "outsiders" to visit there in more than a year. Only military personnel with operating functions have been permitted at the reserve.

In addition to NPN's representative the party leaving Washington included: Al Newman of Newsweek, Fred Graham, New York Times; Richard G. West, New York Herald Tribune; George Connery, Washington Post; Lee Carson, International News Service; Edwin A. Lahey, Chicago Daily News; B. M. Talbot, Jr., New York Journal-American; Gerald Ritson, Newark Evening News. Arlie McTee of Oil Weekly and six West Coast newspapermen were to complete the party.

Negotiations To Be Resumed

CHICAGO—Lt. Com. J. Gordon King, district officer in charge of Navy petroleum plants office of U. S. Naval District 9, told NPN he has been advised by O. A. Knight, president of O.W.I.U. (C.I.O.) that the union will resume negotiations with Sinclair Refg. Co. immediately.

Your Research Has Set the Pattern For the Motor Truck of the Future

● By developing the tremendously improved gasolines and lubricating oils needed to meet the requirements of combat aviation, the laboratories of the petroleum industry have handed motor truck engineers a new kit of tools and a great challenge.

Without much change in present truck engine design—other than increasing compression—these improved fuels should allow some ten to fifteen per cent increase in efficiency. But of tremendously greater importance is the fact that they permit basic design changes which, in combination with the use of new aviation materials, will result in entirely new performance and economy standards in motor transport.

Space here, of course, does not permit a discussion of the engineering program which White is well into and which began two years before the introduction of the Super Power Engine in 1939. Its design borrowed frankly from the best in adaptable aviation design. It made use of materials hitherto used only in aviation.

We at White are not only conscious, therefore, of the possibilities which petroleum technologists have created in the field of improved truck engine design, but also are confident that correct application of your new discoveries will be the largest single factor in making the motor truck of the not too distant future much more efficient and economical than would have been possible to create without this wartime achievement of yours.

K. S. Baster

Vice President in Charge of Engineering
THE WHITE MOTOR COMPANY
Cleveland, Ohio

FOR MORE THAN 45 YEARS THE GREATEST NAME IN TRUCKS

White

Amendment Complaint Needed in A.P.I. Case, Atty. Gen. Clark States

NPN News Bureau

WASHINGTON — Attorney General Tom Clark said this week he was "sure" an amended complaint would be necessary in the A.P.I. anti-trust suit, and denied reports that litigation was being held up because of the oil labor situation.

The attorney general also disclosed that small oil men would be invited to inspect any proposed consent decree in the suit, and that he "saw no harm" in making it public, although "It might establish a bad precedent" for other cases.

Mr. Clark's comments were made at a press conference, at which he reported the lands division was considering possibility of naming other states as defendants in submerged lands suit against California and Pacific Western Oil Co.

A five-man staff, composed of Arnold Raum and Paul Freund, attorneys in the solicitor general's office; J. Edward Williams, acting chief of the lands division; Robert E. Mulroney, chief of trial section, lands division, and Frank Chambers, chief of legislation and general section, lands division, will prosecute suit in Supreme Court, Mr. Clark announced.

The attorney general also said:

1. He "wasn't aware" that FTC's interpretation of Robinson-Patman law in Standard Oil (Indiana) price discrimination case violated Sherman Anti-Trust Law.

2. The Justice Department "went too far" in prayer in the Cement Institute basing-point case, involving "phantom freight" rates, and hereafter would attempt only to supplement FTC's work.

3. FBI had been asked to investigate exclusive dealing and full-line forcing problems, but that it was hard to obtain any evidence in such cases.

4. Hebert Bill (H. R. 4584), introduced in House Nov. 6 and which would brand strikes as "restraint of trade" under anti-trust laws, was "policy matter for Congress to decide." "We try to keep out of things like that," Mr. Clark explained.

5. He had no specific ideas for disposition of "Big Inch" and "Little Big Inch" pipelines, "because I don't know enough about them."

6. All investigation work for anti-trust division hereafter will be handled by FBI, so lawyers do only court house work and investigators determine facts. He said this wasn't criticism of attorneys' investigating work, but merely a plan to increase efficiency.

7. All appellate work will be taken out of divisions, and placed in solicitor general's office, so solicitor generals' office viewpoint would be reflected throughout, and need for rewriting briefs and duplicating other work would be eliminated.

'No Reservation? Don't Come!' A.P.I. Head Warns of Meeting

NPN News Bureau

NEW YORK—"If you don't have reservations, don't come."

Hotel accommodations in Chicago for the American Petroleum Institute's 25th Annual Meeting and Victory Jubilee are that bad, hence President W. R. Boyd Jr.'s unusual words to hundreds who want to attend but do not yet have rooming arrangements made.

Mr. Boyd said the few cancellations to date offer no indication that the situation will change for the better.

A.P.I. Groups Consider Policy on Test Work

NPN News Bureau

CHICAGO—The extent to which the Lubrication Committee of the American Petroleum Institute, the National Lubricating Grease Institute and other groups in the petroleum industry shall carry on work in classifying products and establishing methods of test is to be discussed at two group sessions at the meeting of the American Petroleum Institute in Chicago, Nov. 12-15.

The groups will consider a report of an American Standards Assn. committee, entitled "Policy Committee on Standards", which infers that such functions more properly belong to the American Standards Assn. Charles E. Wilson, president of General Electric Co., is chairman of the A.S.A. committee.

The report will be considered by the Automotive Research Committee, a subcommittee of the A.P.I. Division of Refining, at a meeting Nov. 12. K. G. Mackenzie, The Texas Co., is chairman of this committee. The A.P.I. Lubrication Committee will discuss the matter Nov. 13, at a meeting called by L. C. Welch, Standard Oil Co. of Indiana, chairman.

Many of the petroleum technologists believe the A.S.A. should limit its work to clearing house and promotional functions and that this work of formulating standards for products through test and research should be initiated by their manufacturers or large consumers.

Changes and Additions Made In A.P.I. Meeting Program

NPN News Bureau

NEW YORK—The following changes and additions have been made in the program of the 25th annual meeting and victory jubilee of the American Petroleum Institute at Chicago, Nov. 12-15:

Wednesday, Nov. 14—Group Session, Division of Refining: Col. Donald L. Putt will speak on **"The A. A. F. and Petroleum Research."**

General Session at 2:30 p. m., the same day—C. R. Smith, chairman of the board, American Airlines, Inc., New York, will speak on **"The Relationship Between Rail and Air Transportation."**

Thursday, Nov. 15 — Group Session, Division of Marketing: **"World Supplies of Gasoline, Kerosine and Burning Oils,"** Stewart P. Coleman, Standard Oil Co. (New Jersey); **"Fuel Oil Availability,"** discussion by the following speakers: S. B. Eckert, Sun Oil Co., Philadelphia; E. W. Ison, Sinclair Refining Co., New York; F. G. Shoemaker, Detroit Diesel Engine Division, General Motors Corp.; W. A. Matheson, president of Oil Heat Institute of America, Inc., New York, and vice president of Williams Oil-O-Matic Division of Eureka Vacuum Cleaner Co., Wilmington, Ill.

Production Group Session—Well Spacing and Production Allocation: **"Optimum Well Spacing,"** W. H. Barlow, Ohio Oil Co., Findlay, O. and W. B. Berwald, Ohio Oil Co., Tulsa; **"A Factual Analysis of the Effect of Well Spacing on Oil Recovery,"** R. C. Craze and S. E. Buckley, Humble Oil and Refining Co., Houston; **"The Relation Between Well Spacing and Recovery,"** W. V. Vietti and O. F. Thornton, The Texas Co., Houston; J. J. Mullane, Carter Oil Co., Tulsa, and A. F. Van Everdingen, Shell Oil Co., Inc., Houston.

Production Group Session—Technology of Water Injection: **"Pressure Maintenance by Water Injection, Midway Field, Ark.,"** author of paper is W. L. Horner, Barnsdall Oil Co., Tulsa; **"Interactions Between Interstitial and Injected Water,"** speaker, A. J. W. Headlee, Johns Hopkins University, Silver Springs, Md.

Thursday, Nov. 15—General Session: Address to be made by Bruce K. Brown, vice president of Standard Oil Co. (Indiana), **"Research, Industry and Government."**

New Tax Administration Seen

Special to NPN

INDIANAPOLIS—"An entirely new phase of tax administration may have to be developed if states elect to tax fuels used for air transport or alcohol blends are legislated into use as motor fuel."

That is the opinion of Frank V. Martinek, chairman of the Central Gasoline Tax Evasion Committee and assistant vice president of Standard Oil Co. of Indiana who addressed the two-day conference of Central Refining States Motor Fuel Tax Administrators here last week.

The owner offered maintenance of membership, not wishing to make an issue of union affiliation for returning service-men, but the union refused and warned petroleum suppliers against loading any of C.K.M.'s trucks.

Miller took the case to WLB, but it was reassigned to the Trucking Commission in Washington where the union has filed no brief, refused to appear in person and no decision consequently is available.

Mr. Hadley feels refinery strikes have temporarily delayed this intended movement of unions into the smaller operator field, but that it is imminent.

Anglo-American Oil Treaty Ratification Seen at an Early Date

NPN News Bureau

WASHINGTON—Back in the Senate again is the Anglo-American oil treaty—this time in a form which, according to PAW Ickes, has the "full support of representatives of the oil industry."

Early ratification of the agreement was indicated, with some prospect that the Foreign Relations Committee might take the first step towards final approval before the current week is out. The committee is the same one which bottled up the pact as originally submitted and finally forced its withdrawal for renegotiation with the British.

The revised treaty reached the Senate Nov. 2, along with letter from Secretary of State Byrnes and PAW Ickes, and a list of territories and countries to which it is intended to apply.

The agreement was signed in London Sept. 24, but transmittal to the Senate had been delayed because of a delicate situation with regard to ownership of some of British Empire areas included.

The British did not want the list of territories and countries made public, but the list had to be submitted to Senate for its information. The State Department spent month clearing the list, sent it to the White House last Wednesday.

'A Significant Milestone'

President Truman's letter of transmittal made no comment on the pact, but PAW Ickes called it "a significant milestone in our progress toward a better economic order for the world."

Mr. Ickes said the agreement represented success of an undertaking commenced over year and half ago, and added:

"It is gratifying, indeed, to be able to report to you (the President) that an accord has thus been reached with the British in relation to oil—a commodity that is so indispensable in war and peace," he told the President.

The nation's oil boss acknowledged "the fairness, the co-operation, and the warm spirit of friendship" manifested by the British government, and said this spirit "augurs well for the success of the compact." Accordingly, he went on, he submitted the agreement "with a feeling of high confidence in its potentialities as an instrument of economic advancement."

A Preliminary Measure

Secretary of State Byrnes emphasized the treaty had been negotiated as a preliminary measure to the calling of an international conference to consider negotiation of multilateral petroleum agreement to which governments of all interested producing and consuming countries may become parties and which, among other things, would establish a permanent International Petroleum Council.

His letter, which outlines purposes treaty is designed to serve, says no provision of the agreement would require either government to act upon any report or proposal made by the commission or require the nationals thereof to comply with any such report or proposal.

Furthermore, Mr. Byrnes points out, none of the provisions of agreement (with exception of Article II, which provides equal opportunity in regard to acquisition of exploration and development rights in territories of the other nation), would apply to the operation of the domestic petroleum industry within the country of either government, or impair or modify any law or regulation or the right to enact any law or regulation relating to importation of petroleum into country of either government.

List of countries and territories to which pact is intended to apply:

1. Of the United States of America—the continental United States, Alaska, Hawaii, Puerto Rico, Virgin Islands, Panama Canal Zone.

2. Of the United Kingdom of Great Britain and Northern Ireland—the United Kingdom; Aden; Bahamas; Barbados; Basutoland; Bechuanaland protectorate; Bermuda; British Guiana; British Honduras; British Solomon Islands Protectorate; Ceylon; Cyprus; Falkland Islands and dependencies; Fiji; Gambia (colony and protectorate); Gibraltar; Gilbert and Ellice Islands colony.

Gold Coast (a) colony, (b) Ashanti, (c) northern territories, (d) Togoland under British mandate; Hong Kong; Jamaica (including Turks and Caicos Islands and the Cayman Islands); Kenya (colony and protectorate); Leeward Islands—Antigua, Montserrat, St. Christopher and Nevis; Malay States: (A) Federated Malay States—Negri Sembilan, Pahang, Perak, Sclangor; (B) Unfederated Malay States—Johore, Kedah, Kelantan, Perlis, Trengganu, and Brunei; Malta; Mauritius; and New Hebrides.

Nigeria (a) colony, (b) protectorate, (c) Cameroons under British mandate; state of North Borneo; Northern Rhodesia; Nyassaland protectorate; Palestine (excluding Transjordan); St. Helena and dependencies; Sarawak; Seycheles; Sierra Leone (colony and protectorate); Somaliland protectorate; Straits Settlements; Swaziland, Tanganyika territory; Tonga; Transjordan; Trinidad and Tobago; Uganda protectorate; Virgin Islands; Windward Islands—Dominica, Grenada, St. Lucia, St. Vincent; Zanzibar protectorate.

Baruch Supports Science Foundation Legislation

NPN News Bureau

WASHINGTON—Bernard Baruch last week gave complete support to legislation for a National Science Foundation, but warned the Senate Kilgore Subcommittee on War Mobilization that a national inventory of oil and other resources is a "must" if the proposed organization is to function successfully.

He testified at subcommittee's hearings, which ended later in the week, on two science foundation bills: the Kilgore-Magnuson bill (a combination of S. 1297 by Sen. Kilgore (D., W. Va.), and S. 1285 by Sen. Magnuson (D., Wash.)) and on Sen. Fulbright's (D., Ark.) bill, S. 1248.

Baruch's view on the form that the Science Foundation should take coincides with that of many oil industry leaders. In his opinion, it should consist of men "selected solely for the contributions they can make to the advancement of science," who should be given full powers and responsibilities. He also recommended that their executive director be appointed by the President on nomination of the Science Board.

On the subject of patents, Baruch said that where the government foots the entire cost of an experiment, any patentable results should belong to the public rather than any private interest.

Uncle Sam Takes Neat Profit Resells Land, Keeps Minerals

Special to NPN

VINCENNES, Ind. — Defense Relocation Corp. bought land tracts in Knox County with mineral rights and is now selling them without those rights, it became known last week.

The land, purchased in 1941 and 1942 for military installations is going to private citizens, including farm co-operatives. But 100% royalties on all oil, coal or other minerals in this proven-oil area, is reserved to Uncle Sam.

The government originally bought one 356-acre tract under impending condemnation proceedings for $32,770; it has recently been sold to new owners for $37,800—$5,030 profit to the government and the value of any future mineral discoveries.

Daily newspapers in Indiana are openly grumbling about a "federal land grab bite". Investigators of the 14,195-acre sales in five counties say in nearly all cases the shrewd DRC is taking a neat profit on increased land values, plus the mineral potential.

Companies Sue Each Other—Ceiling Price An Issue

Special to NPN

RICHMOND, Va.—Two oil companies are suing each other in federal court here—and ceiling prices are the basic issue.

Federal Judge R. N. Pollard heard arguments last week on motions for summary judgement against James River Oil Corp. for $40,428.07 which the Arkansas Fuel Co., a West Virginia corporation, says is due for petroleum products purchased between March 10, 1943, and Nov. 2 of the same year.

On the other hand, the James River firm, a Richmond company, is counter-suing for $43,470.72, claiming the Arkansas Fuel Co., refused to sell at ceiling prices, forcing James River to buy elsewhere.

James River's attorneys say $3,-171.77 is the actual difference between ceiling prices of goods bought from Arkansas Fuel and the amount actually paid when the amount Arkansas seeks was credited. They also ask $40,298.65 in damages they say occurred because Arkansas would not sell at ceiling prices.

Judge Pollard took the case under advisement.

Welcome Back - - -

And Other News About Oil Soldiers and Sailors

Lieut. Col. Donald A. Bering has resumed his association with Shell Oil Co. During the war he served with the Air Corps, supervising maintenance and refueling of aircraft and vehicles in combat operations. Lt. Col. Bering received the Bronze Star Medal, Unit Citation and five Battle Participation awards. Formerly, an engineer with Shell Co., he has now been appointed senior engineer with the automotive division.

♦ ♦ ♦

Lieut. Col. Jerry Sadler, who resigned as a Texas Railroad Commissioner to join the army as a private, is back in civilian clothes and is the subject of many a wary glance from Texas politicans.

NPN learned that Col. Sadler has already told friends he is definitely in the race for Governor of Texas next summer, and his entry into the ring is confusing an already muddled political race.

Col. Sadler, who made political capital out of his snuff-dipping, spent most of the war in the Near East directing the movement of war goods to Russia, and for his work was awarded the Order of the Fatherland by the U.S.S.R.

He was introduced at the last statewide proration hearing in Austin by his former colleague, Commission Chairman Olin Culberson. While in the Texas Commission, Sadler and Culberson usually voted together, making Col. Ernest O. Thompson the minority member. Sadler was succeeded on the Commission by Beauford Jester, who is also reported to be an aspirant for the Governorship next year.

♦ ♦ ♦

Com. Almy C. Maynard has rejoined Shell Oil Co. where he was a liquefied gas representative before assuming war duties. Com. Maynard served with the USNR at Mare Island Navy Yard as an industrial conservation officer. He is now sales superviser at the San Francisco headquarters of Shell Oil.

♦ ♦ ♦

LST 1083, the first landing craft to drop anchor in Japanese home waters, was commanded by **Lieut. D. B. Jeffries** of Rockport, Tex. Lieut. Jeffries is a member of the laboratory force on special military leave from the Ingleside refinery of Humble Oil and Refining Co.

Correction

Under "Welcome Back" in NPN, Oct. 24, **Capt. Carl G. Triest** was reported as returning as assistant to the president of the Lion Oil Corp. He is returning to a similar post with the Alliance Oil Corp., not Lion Oil. NPN regrets the error.

Lieut. Com. David C. Sloane, formerly assistant regional manager of Sun Oil Co.'s Middle Atlantic region, has returned to the company after more than three years of Navy service. He has been appointed merchandising assistant of the Middle Atlantic region in charge of an expanded TBA program.

Com. Sloane served in Dutch Guinea from May, 1942, to November, 1943, as U. S. naval observer handling intelligence and expediting bauxite production. He was attached to the Army-Navy Petroleum Board in Washington for the following three months, and in January, 1944, went to Pearl Harbor as operations officer in the port director's office.

Com. Sloane first came with Sun Oil in 1924 at the company's Marcus Hook (Pa.) refinery, and in 1933 joined the sales department, where he worked up through the ranks to become an assistant regional manager.

♦ ♦ ♦

Capt. Herbert E. Schnur, who succeeded **Lieut. Col. B. F. Hake** as chief of the planning branch, Army Fuels and Lubricants Division, Office of Quartermaster General on Oct. 15, is returning to The Texas Co. as a special auditor in the company's New York executive offices. Entering the Army as a private in June, 1942, Capt. Schnur was assigned to special research on German and Japanese Oil resources in 1943. His studies centered about what oil supplies the enemy had and what it could produce.

♦ ♦ ♦

Aubrey T. Gholson, recently discharged from the armed services, has joined the Hovey Petroleum Co. in Houston. Prior to his Army service, Gholson was a deputy petroleum inspector for 12 years.

Brig. Gen. Howard Peckham Is Awarded the DSM

Brig. Gen. Peckham

NPN News Bureau

WASHINGTON—Brig. Gen. Howard L. Peckham, director of the Fuels and Lubricants Division, Office of Quartermaster General, has been awarded the Distinguished Service Medal, and Col. Jay L. Taylor, former executive officer of the division, now back with Halliburton Oil Well Cementing Co., has received the Legion of Merit.

The presentations were made by Lieut. Gen. Edmund B. Gregory, quartermaster general.

Accompanying citations read as follows:

"Brigadier General Howard L. Peckham performed exceptionally meritorious service in duties of great responsibility as deputy director and director of the Fuels and Lubricants Division, Office of the Quartermaster General, from October, 1943, to September, 1945, by procuring and allocating fuels and lubricants to the military forces of the United States. The supply of these essentials to the mechanized fighting forces was a matter of highest importance and greatest urgency, and the success of campaigns in the European and Pacific theaters was largely dependent upon the speedy accomplishment of the petroleum supply mission of the Quartermaster Corps. Through his keen grasp of the problems involved and his unusual organizing ability, General Peckham effectively and continuously manipulated the operations of the division to meet new demands created by ever-changing conditions on the fighting fronts. Drawing upon his vast knowledge of the petroleum industry and applying himself untiringly to his task, he achieved practical solutions to complex problems, thereby contributing notably to the successful prosecution of the war."

"Colonel Jay L. Taylor performed exceptionally meritorious service as deputy director of the Fuels and Lubricants Division and deputy director for operations, Office of The Quartermaster General, during the period June, 1943, to August, 1945. He contributed in a high degree to the uninterrupted flow of petroleum to the mechanized fighting forces in the European and Pacific theaters, thereby assisting in the acceleration of the war effort and the speedy end of hostilities. His unusual organizing ability and thorough knowledge of the petroleum industry guided the Fuels and Lubricants Division to successful accomplishment of its mission under constantly changing conditions. Through his keen analytical ability and untiring effort he solved many complex problems which appreciably aided in the prosecution of the petroleum supply mission of the Quartermaster Corps. Colonel Taylor's accomplishments during a period of grave national emergency are in the highest tradition of the service."

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of experience in the building of floating roofs
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other evaporation saving equipment

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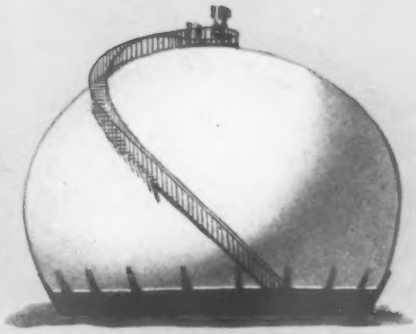
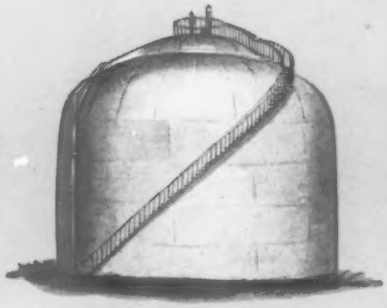
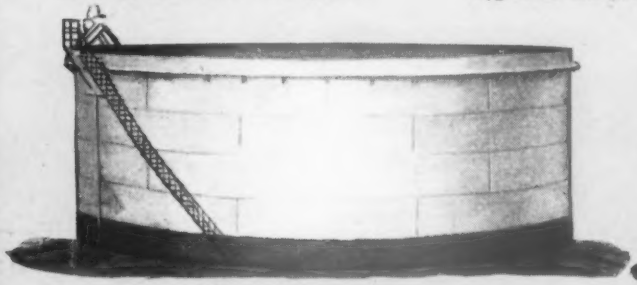
HORTONSPHERES . . . are used by the petroleum industry for the storage of highly volatile liquids and gases. They prevent evaporation loss by allowing pressure to build up inside the tank instead of venting. Hortonspheres are available in standard capacities from 1,000 to 20,000 bbls. for liquids, and from 20 to 65 ft. in diam. for gases.



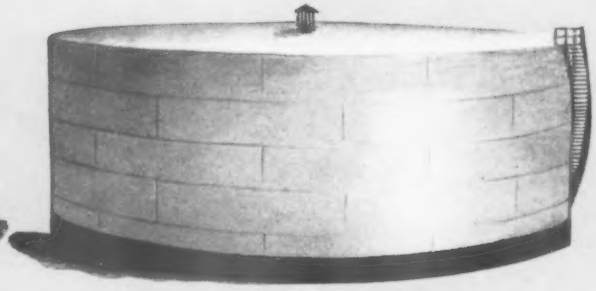
HORTONSPHEROIDS . . . are large capacity pressure tanks for storing hydro-carbons ranging in volatility from motor fuel to natural gasoline. Smooth Hortonspheroids are built in capacities of 2,500 to 40,000 bbls. for pressures from 2½ to 35 lbs. per sq. in. and noded designs from 20,000 to 120,000 bbls. for 2½ to 20 lbs. pressure.



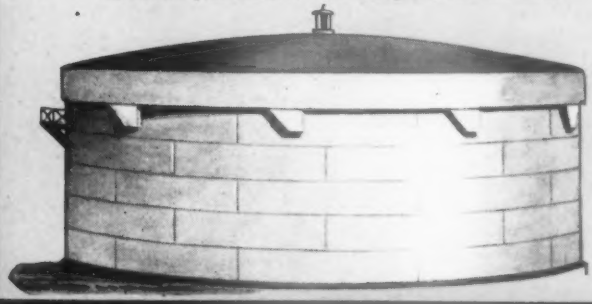
HEMISPHEROIDS . . . provide an economical means of storing liquids that are only slightly volatile, requiring pressures of only 2½ to 10 lbs. per sq. in. to stop standing storage losses under normal operating conditions. Built in sizes from 2,500 to 20,000 bbls. (Noded Hortonspheroids are used for capacities over 20,000 bbls.)



WIGGINS* FLOATING ROOFS . . . are supplied for installations where the volatility of the oil does not require the insulating qualities of the Horton roof. These roofs, in varying specific forms, have been used extensively on tanks storing sour crude oil and will hereafter be available in forms particularly well adapted for this use.



WIGGINS BREATHER* ROOFS . . . are used to reduce breathing losses on standing storage tanks. They are particularly recommended for tanks 60 ft. in diameter or larger that are kept full or nearly full most of the time.



HORTON LIFTER ROOFS . . . reduce evaporation losses from standing storage or slow working tanks. The vapor spaces of several adjoining cone roof tanks are often connected to the vapor spaces of a tank with a lifter roof.

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How the Oil Industry Did the War's Best Civilian Job

Petroleum Administration, Staffed by Oil Men, Met the Requirement of the Biggest War in History; Didn't Need and Didn't Have an Enforcement Division To Carry Out Its Many Directives, Orders, Recommendations

Oil to back the attack!

Behind this catchy slogan of World War II is a great dramatic story. It's a story which never will be told in its entirety, a story which never will be complete because the individual wartime oil experiences of all participants never will be completely recorded. And in the final analysis, it was the individual experiences of oil men, in industry and government, that made oil's unprecedented wartime partnership a phenomenal success.

This industry-government partnership was one of war's outstanding achievements. It was an achievement largely organized and directed by the government oil agency which was first known as the Office of the Petroleum Co-ordinator and later as the Petroleum Administration for War.

The Co-ordinator and Administrator, Secretary of the Interior Harold L. Ickes, and his Deputy Co-ordinator and Administrator, Ralph K. Davies, after working together for more than four years, paid oil men the highest of compliments at a testimonial dinner, last Oct. 23, given in honor of OPC-PAW's two ranking executives. In essence, they said:

> Without any enforcement agency of any kind, OPC-PAW worked because it was in the hearts and minds of the oil men, in industry and in government, to make it work. In short, it was accomplished because of a characteristically bold, determined and enviable spirit.

During the entire war, oil men worked with the knowledge that "the time is short; the time is now." And for all time, history will record it a major accomplishment.

But the accomplishments of this oil agency have been heeded by more than the oil men themselves, for only recently Congressman Clarence Cannon, chairman of the powerful House Committee on Appropriations said:

"I would like to say that there was no more essential activity or agency in the war than the Petroleum Administration. It did a wonderful job. All of our war machinery of any character, on land, sea, and in the air, absolutely depended on fuel; and so far as I have been able to determine, there never was a case where any of the units were immobilized for lack of gasoline or lack of any other kind of fuel, or was there any time when any of our forces were inconvenienced for lack of petroleum products.

"You (addressing PAW representatives present at the committee hearing) have the working procedure of the five district offices, and Recommendation 70 which governs the program and shipments of foreign supply and transportation. (Recommendation No. 24 established the Petroleum Industry War Council, an agency which will probably be closing shop, at least under its wartime name, in the very near future).

OPC-PAW is rapidly reaching its end, but the memories, friendships, heartaches and even marriages which resulted from this wartime agency will linger for years to come. NPN—which covered the day-to-day developments of this oil agency from all points of the country—is, so to speak, seating itself, ordering another cup of coffee, lighting its pipe, and looking back. First, we see:

Edwin W. Pauley, president of The Petrol Corp., Los Angeles, and somewhat of a political figure, being vice-president of the Democratic National Committee. And while opinions may differ, several usually accurate sources have said that the original idea for some sort of a government oil agency such as OPC, originated with this California oil man at a meeting on, or about, May 1, 1941. This was just about the time when the United States had transferred to Great Britain the equivalent, in tonnage, of 50 tankers. (By actual count, 43). When Mr. Pauley done a wonderful job, and I think I can express the appreciation of the committee that you, contrary to the situation we find in some of these other activities, seem to be as interested in saving any surplus funds as the committee is and seem to be anxious to close up your operations and get rid of them as soon as possible."

It should be borne in mind that these highly complimentary remarks came from practically the same Congress which had, from the very inception of this oil agency, been suspicious of oil men in government running oil men in industry.

ESTABLISHED AN UNUSUAL RECORD

And most certainly it should be borne in mind that this oil agency established an unusual record—as far as government agencies are concerned anyway—in keeping its many promises, principally the one to disband when the job was over. Evidence of this is the testimony, given before the same appropriations committee, that this oil agency, which employed 1,475 men and women at its peak, would be down to 25, or less, by

Rubber vs. 100-Octane Discussed Before Committee

In May, 1943, rubber vs. 100-octane was discussed at a Truman Committee hearing. Above facing the committee at center table are, left to right, Deputy PAW Ralph K. Davies, assistant Deputy PAW Bruce K. Brown, Max B. Miller, head of 100-octane construction program, and PAW Administrator Harold L. Ickes

PAW officials attended hundreds of meetings and were on hand at many hearings as illustrated by this picture, taken during testimony of Deputy PAW Davies before the Lea committee May 19, 1944. Assistant Deputy and Chief Counsel J. Howard Marshall (leaning over chair) confer with Bruce K. Brown, assistant deputy (on left with legs crossed) and Marketing Director Walter Hochuli. At left is Transportation Director George Wilson. Looking towards camera (between Mr. Brown and Mr. Marshall) is Production Director Don Knowlton

the end of this year. Moreover, of the 80 recommendations and directives, plus petroleum administrative orders, and petroleum distribution orders, only two now remain in effect; they are:

Recommendation No. 7 which set up came east with his oil agency idea, he talked with the late President Roosevelt who referred him to Secretary Ickes.

Shortly after this, the country was informed of the new legendary Presidential Letter of May 28, 1941, establishing the Office of Petroleum Co-ordinator, and the simultaneous announcement that Mr. Ickes would be top man.

News of this startling proposal left most oil men in a quandary. Four years later, at the Oct. 23 dinner, the Petroleum Administrator was hailed in the following words:

He "brought into being the greatest Government-industry partnership in the history of the United States. By dint of that partnership, tested in the crucible of war, the petroleum industry has come to know him as an administrator of pre-eminent stature, and as a man of vision, courage and statesmanship."

AN OIL MAN ENTERS

The oil industry, it will be readily recalled, is not given to praising men—and least of all the Secretary of the Interior, whom it had "hailed" in much different terms just a few years ago. So the question arises, what happened to change their minds?

Ordering another cup of coffee and changing our pipe to a cigar, we now see another man, this time an oil man, pushing aside the massive doors of the New Interior Department Building in Washington. He's from California, in fact a vice-president of the Standard Oil Co. of California, and one in whom the Secretary of the Interior, long since had come to admire for his forthright stand on petroleum matters, particularly conservation.

An oil man is to be the deputy administrator, the oil industry heard. But not everyone was happy, not even all oil men. In fact at least one petroleum industry representative worked his way into Mr. Ickes's office to state that "this man Davies is a tool of the major companies." Mr. Ickes listened. Mr. Ickes threw back his head, looked at the ceiling, considered all the other evidence he had to the contrary about "this man Davies," then, in characteristic fashion jutted his jaw at the visitor, and bellowed:

"Just the same, and regardless of what you say, Davies stays. Let's get on with the job, and as for you: Get the Hell out of my office!"

With a boss such as this, Mr. Davies has since openly confided: "How could anyone do anything but his best." And as to the type of job Mr. Davies did, the following is the industry's opinion, as expressed at the Oct. 23 banquet:

Under the guidance of "the field marshal of the nation's oil forces," Deputy Administrator Davies guided the industry-government machine. "To these high duties he brought profound oil knowledge, an incisive intellect, rare vision, the quiet power of a gifted organizer and executive, the courageous devotion of a man characterized by unflinching determination and a deep sense of public service."

Still the petroleum industry rubbed its collective jaw; hands were run through grey hair, if any; and oil men wondered: What's up? Is this a sugar-coated pill? Is this the beginning of federal oil control? In short, even the advent of Oil Man Davies, at first, didn't entirely allay suspicions. After all "this man Davies," many oil men figured, "has been to Washington before. He knows his way around, and maybe, just maybe, he's been bitten by that New Deal bug and is out to socialize, in a mild form, perhaps, the sprawling petroleum industry."

APPOINTMENTS MADE TO NINE IMPORTANT OPC POSTS

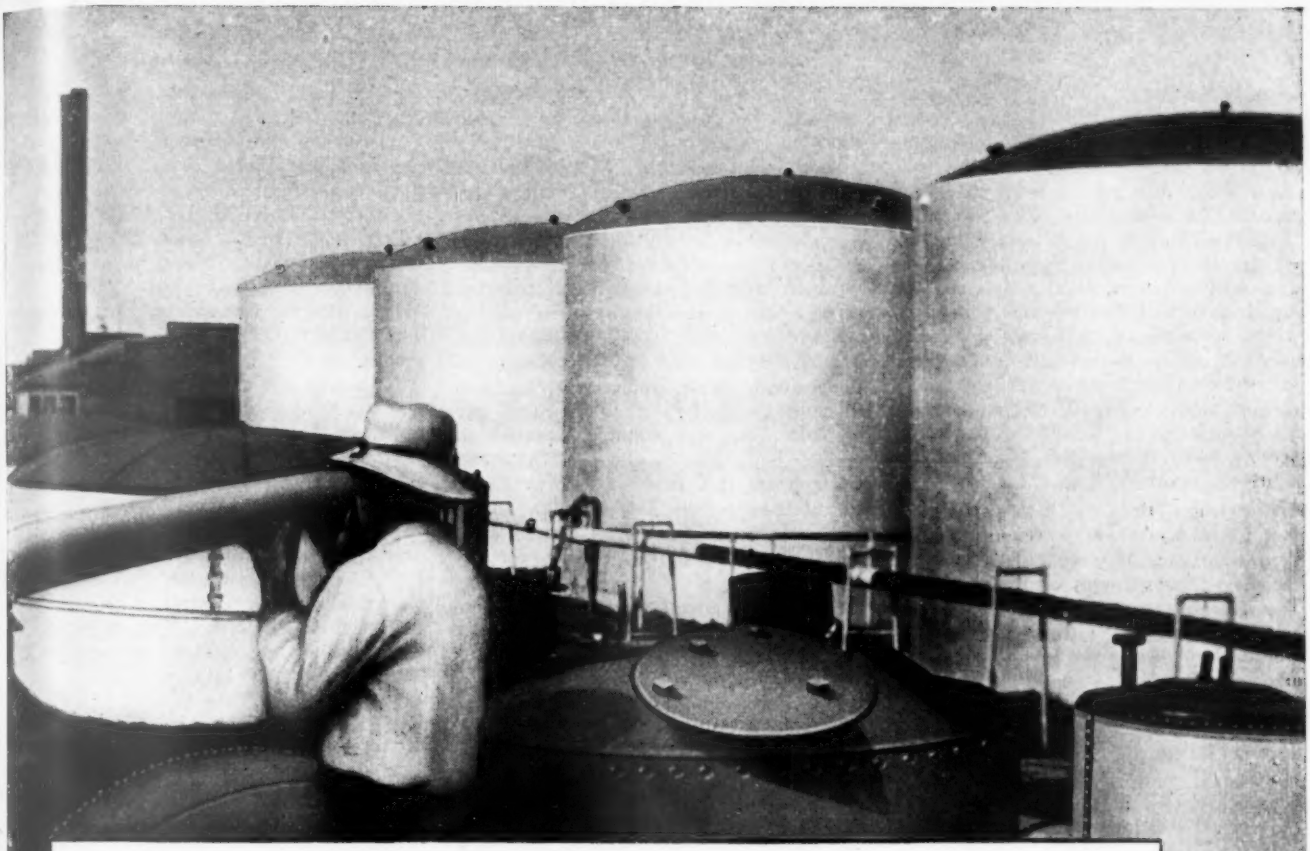
However, the apparent good faith of "oil's top kick and his partner" became a bit clearer when OPC (as it was known in the early days) announced the appointments to nine important OPC posts. The names follow:

Special Assistant to the Deputy Coordinator: George W. Holland—from Interior Department's Petroleum Conservation Division; Director of Production: Robert E. Allen—an oil man of long standing and one who came to OPC direct from the Petroleum Conservation Board in Calgary, Canada; Director of Refining: Wright W. Gary, another well-known oil man who was once connected with W. M. Kellogg Co., and later was a consulting refiner on his own; Marketing Director: Dr. John W. Frey, from Interior's Petroleum Conservation Division and a well-liked government executive by majors and independents; Research Director: Edward B. Swanson, Interior's Petroleum Conservation Division and a man who knew his way around when it came to oil industry economics; Conservation Director: the legendary Everett Lee DeGolyer, internationally known petroleum geologist; and as Public Relations Director: Herbert A. Yocom, a well-seasoned Associate Press writer who is now NPN's Washington news bureau chief.

It's interesting to note that of all the oil men who were, at one time or other, connected with OPC and/or PAW, that there are only two men who still hold the same position today as they held more than four years ago. They are: Deputy Administrator Davies and Research Director Swanson.

From a staff of less than a dozen, located in a few offices on the sixth floor of the new Interior Department Building in Washington, OPC grew to a peak of 1,475 in July of 1943, with the staff stationed all over the United States, but principally in the five district offices and in Washington. Of this 1,475 total, Administrative Director E. J. Skidmore estimates that 800 were in the so-called top, middle and lower policy-making levels, and that of the 800 figure, 70% were oil men on leave from their companies. The remaining 675 were clerks, stenographers and messengers.

But back to the newly-appointed directors. The oil industry looked them over, saw several Interior men included, and while these government career men were well known and liked by the oil industry, they were still government



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3. **INDEPENDENT OWNERSHIP.** Strict privacy. We do not buy, sell, or refine oils.
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men. However, it wasn't overlooked that Allen, Gary and DeGolyer were prominent names on that list, and not a single oil man doubted their motives. So maybe this government oil group wouldn't be so bad after all.

And while this debate was going on, in plush-carpeted offices and oil-drenched refineries, OPC announced the appointments of 204 oil men—many of whom were the same "doubting Thomases" to act on nation-wide district advisory committees. Moreover, the names ranged from large oil company presidents such as the late John Brown of Socony-Vacuum, to Wiley Moore, of the relatively small Wofford Oil Co.

And when "the little guys" squawked that too many majors were on this list, more independents were added. The oil industry always highly articulate in its own demands, continued to be so in this new and startling government-industry relationship. After all, oil men are—oil men, whether beside a derrick watching for a well to blow its top, or in the Interior Department's conference room waiting for Mr. Ickes to act likewise.

ASSISTANT DEPUTY PETRO-CO-ORDINATORS NAMED

Shortly after the advisory committees had been named, administrative problems became too many and were too diverse for Mr. Davies to handle alone, so the first of several Assistant Deputy Petroleum Co-ordinators was named, the first being Bob Allen who was moved up from production director, his place being taken by Donald R. Knowlton, of Phillips Petroleum.

But if OPC thought it was commencing to have too many administrative problems, this was just the beginning of still other problems, for while OPC was not yet fully organized, Capitol Hill commenced to wonder: "What are those oil men in government doing to oil men in industry, and finally to the country at large." It was time to take a look the solons decided.

"After all," Congress pondered, "we're not at war; yet tankers have been transferred to British service; Ickes has asked for a 33 1/3% voluntary curtailment (Recommendation No. 1) of gasoline in the East Coast area; and OPC was instrumental in getting the Office of Price Administration and Civilian Supply (OPACS—the predecessor of OPA) to allocate gasoline consumption, in August of 1941, 10% below July demand in the 17 East Coast states." So, rightly or wrongly—and under our constitutional set-up, one doesn't refuse "invitations" to appear before a Congressional committee—the government oil men commenced the first of more than 100 trips to the far end of Pennsylvania avenue.

In fact, these trips became so frequent that Administrator Ickes was soon affectionately—well, more or less—dubbed "Capitol Hill's favorite witness."

No man who ever worked for OPC or PAW needs to be told that a Congressional investigation is "just another of those things", though Robert L. Minckler of General Petroleum and onetime chief of the Supply Division might disagree. But "Bob" was of a rare species unto himself. To his colleagues, a Congressional investigation was not something to be trifled with. In fact, it became so much of a problem that within a short time after OPC was organized a liaison officer was named to keep in touch with what Representatives and Senators, as well as other state and city officials over the country, wanted to know about oil problems. The man selected for this job was Adolph Levy, an oil lawyer from Los Angeles, and a man who probably will be around until PAW closes its doors, for the government oil agency still has another Congressional investigation to attend; this time, the Senate Petroleum Investigating Committee (not exactly an original title), of which Wyoming's Senator O'Mahoney—of TNEC fame—is chairman.

Typical of Bob Minckler's reactions to these "annoying disturbances" caused by residents of Capitol Hill and governors and mayors of various states and cities, was an incident which occurred when Massachusetts' Governor Tobin (then Mayor of Boston) told Administrator Ickes, on a special trip to Washington, that "even the fuel supply of Boston College was running low."

Mr. Minckler gave the mayor a quizzical eye and retorted:

"What's the worry, Mayor, the football season is over, isn't it?"

PLEASANT TO DEAL WITH

But this should not be construed as a typically flippant attitude of General Petroleum's Minckler, for it's well known that he did yeoman work in the difficult spot he was in, and he was more often, than not, on a spot, and usually a hot one. It was, however, this Will Rogers' type of dry humor that made it pleasant to deal with Supply Director Minckler —even though Congresswoman Edith Nourse Rogers (Rep., Mass.) "never could quite understand that man," as she once confided to an NPN writer, after having complained—at the height of New England's worries over a possible fuel oil shortage—that "an old woman died in Boston just the other day," inferring that it was from lack of fuel.

Again, Mr. Minckler threw out a calm quizzical look and replied:

"Mrs. Rogers, we have the same trouble in California; people die there, too —from old age."

Incidents like these, usually related in the Interior Department's spacious cafeteria, "down under", or in the Executives' dining room on the first floor—did a lot toward maintaining morale.

But there were few laughs when this government agency found it necessary to deal with not just Congress but with a multitude of other government agencies, in order to get things done. For instance, the following is a partial list of agencies with which OPC-PAW men were constantly in contact:

OPA, ODT, NDAC-OPM-SPAB-WPB, ODT, ICC, BEW, Lend-Lease, RFC, Commerce, State, Navy, War, Joint Army-Navy Petroleum Board, Treasury, White House, Bureau of the Budget and a host of others which oil men will readily recall. But it was either "deal with 'em or don't get things done," and getting things done was the primary objective.

However, when it became evident, in the closing months of 1941, that OPC lacked the power to act with authority, an attempt was made, in several of the drafts which led to the creation of the Petroleum Administration for War, to eliminate the oil control exercised by these other agencies. The howl that went up will be explained in this "back in the days when" article.

ICKES VISIONS PIPELINE

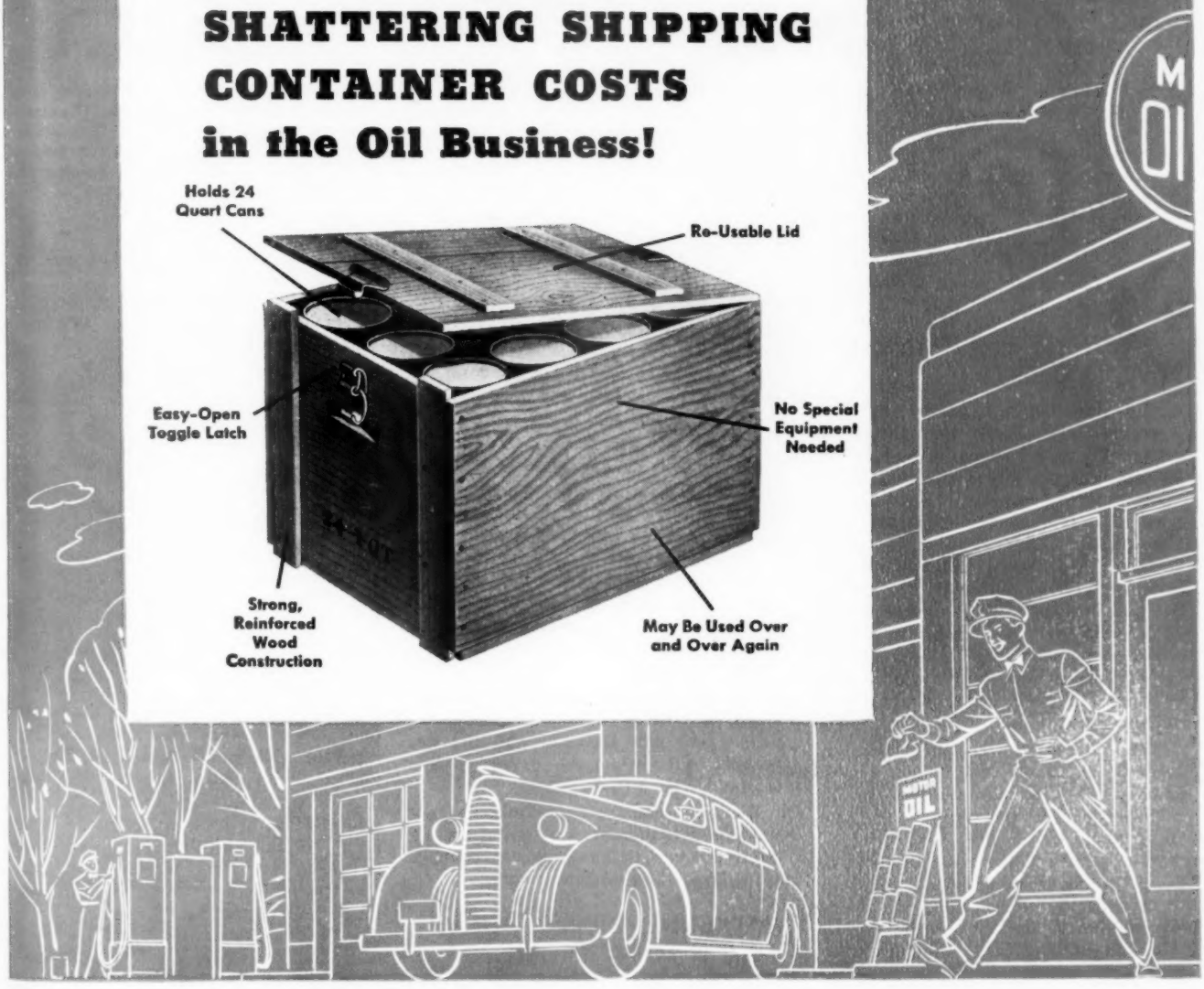
It was in the summer of 1941 that Administrator Ickes first visioned a pipeline from the Gulf to the East Coast, the pipe line which is now the "Big Inch", and one about which there is now no argument in the vital wartime role it played. But back in 1941, most of Washington, and some of the oil industry thought that "the old man was crazy." At any rate, OPC had no luck in getting the necessary steel allocated from WPB, or SPAB (Supply Priorities and Allocation Board) as it was known in those days.

Later, when it became increasingly evident that this line must be built, Deputy Administrator Davies attended a meeting at which Henry Wallace, then vice-president, was chairman, and while Mr. Davies was explaining the need for this steel, a note—so the Washington legend has it—from Harry Hopkins was slipped to Mr. Wallace. He read it, and with a wave of his hand indicated that "enough has been said about steel for this pipeline." This is one of the bitter pills that "Field Marshal" Davies has had to swallow from time-to-time during his 52-month stay in Washington. But steel for the pipeline was finally obtained after numerous conferences with officials in other agencies and visits by Secretary-Petroleum Administrator Ickes to the White House. But exactly what Mr. Davies thinks of the Harry Hopkins-Henry Wallace team is something which history probably never will record.

The petroleum transportation problem was becoming critical. Of this there was little doubt. Recommendations No. 2 and 3 emphasized it. Recommendation 2, it will be remembered, requested companies to eliminate cross-hauling and to use joint terminal facilities, as well as exchanging and loaning products on a scale never dreamed of under normal

Here's the Box that's SHATTERING SHIPPING CONTAINER COSTS in the Oil Business!

Holds 24 Quart Cans
Re-Usable Lid
Easy-Open Toggle Latch
No Special Equipment Needed
Strong, Reinforced Wood Construction
May Be Used Over and Over Again



In a shake-down test by a major oil company this box made 34 round trips... cut shipping container cost to less than 3c per 24 quarts

Here's the first really new development in shipping containers for packaged oil, in years! A double-tough, reusable wooden box that cuts container costs to as little as 3c per 24 quarts, depending on the quantity purchased.

Already this sensational Sullivan-built box is hustling oil from refinery to dealer for some of the biggest names in oil. We'll be glad to send you a sample, without obligation.

No nailing — no special tools needed. May be used over and over again.

Write for Samples and Prices

SULLIVAN BOX FACTORY

SULLIVAN BOX FACTORY

Sullivan, Ill.
PHONE: L. D. 7

conditions. We were not yet in war, but it was drawing dangerously close.

Recommendation No. 3 was aimed at the elimination of unnecessary trips, such as special deliveries by department stores, and the unnecessary special trips made by other commercial vehicles.

The national situation was getting worse. Recommendation No. 4 urged the closing of service stations from 7 p. m. to 7 a. m. daily, along with a joint request to the public, again urging them to save gasoline. Recommendation No. 5 caused many an East Coast executive to sit up a bit later nights, as it requested the general refining, marketing and transportation committees to prepare a program for "equitable distribution in 17 East Coast states and the District of Columbia"—the latter a most familiar phrase to the thousands of oil men in the East Coast states.

PIWC IS CREATED

The situation was getting so much worse that OPC, shortly after putting out its first 23 recommendations, issued No. 24 which is possibly as familiar to the oil industry's executives as any. It created the Petroleum Industry War Council, then the Petroleum Industry Council for National Defense. It was comprised of 66 oil men, representing big and little interests, and was formed in order to give the industry a monthly chance, to complain about, comprise on, or suggest discarding entirely, ideas to coordinate government planning with industry operations.

And just how well this idea succeeded will be told in length in a forthcoming NPN article devoted to the achievements of this "super oil council."

At any rate, if one were to go in for things prophetic there would be plenty of thought in the fact that this overall oil group held its first historic meeting less than 24 hours after the Japs struck Pearl Harbor. It's a day that will—as the late President Roosevelt said—"live in infamy," but it's also a day that will be remembered by all 66 oil participants for more than that. For shortly after their initial meeting with Petroleum Coordinator Ickes, they saw the Secretary of the Interior leave to be present before Congress, with other members of the President's Cabinet, when war was declared. Those were stirring days, and the rapidly-moving events indicated more strongly than ever the tremendous job that the petroleum industry would be called on to do.

The slogan, "Oil is Ammunition. Use it Wisely," never had a more profound meaning than on Dec. 7 and 8, 1941.

But more than stirring thoughts were on the move in those days, for crude oil and petroleum products were being hiballed over the rails, between the Gulf Coast and the Mid-West, to the East Coast at an ever-increasing pace. From practically nothing, in normal times, when—generally speaking—only special types of petroleum are moved at any great distance by tank car, at least into the East Coast, the daily tank car movements of petroleum and petroleum products zoomed to 1,027,011 bbls. daily for the week ending July 10, 1943.

A closer understanding of the industry's problems, and a better relationship with oil management resulted from dinners, such as the above testimonial banquet given on the occasion of the departure of W. W. Vandeveer, Dist. 2, Director-in-Charge of PAW on Nov. 30, 1944. Left to right are: Paul G. Blazer, Mr. Vandeveer, O. D. Donnell, chairman of Dist. 2 General Committee of PAW, E. G. Seubert, E. J. Bullock, who succeeded Mr. Vandeveer, and B. L. Majewski, chairman of Dist. 2 Distributing and Marketing Committee

The interest displayed in the weekly tank car movement almost equaled the baseball averages and football scores. But again, it wasn't accomplished as easily as it may sound here, as OPC's transportation men, working closely with industry, sweated out many a week and month in this all-out, and decidedly unusual method of moving oil to the East Coast.

But tank car movements were the last resort, as tankers commenced to be torpedoed, the only phase of war that was brought directly to the eastern shores of the U. S.

War was taking a heavy toll, and not a single OPC division was spared a thing when it came to an increasing number of wartime oil problems.

MARKETING DIVISION DEALT WITH MANY PROBLEMS

For instance, the marketing division, which was ably directed, first by Dr. Frey, then by Robert T. Collier, of Great Lakes Carbon and Shell Oil, and finally by Walter Hochuli, of the Texas Co., found that it had to deal with a multitude of problems, including even the lack of containers, so a special container and lube oil section was established with Sinclair's Howard Cooper as chief. Other special division sections also were created, including fuel oil, with its first chief being the able Ned F. Foulds, of Ohio Standard and later of the Southern New England Ice & Fuel Co. Following his Washington experience, Mr. Foulds handled the vital fuel oil problems in District 1 direct from the New York office.

A "bear" for facts and figures, Joseph H. (Joe) Ellender, a former Lehman Bros. man whose oil industry experience was wide even before his Lehman affiliation, headed the Economics and Analysis Section.

Other special sections and their chiefs included: Equipment—Robert W. MacMillan; Manpower—A. W. Roth; and Motor Fuels—C. B. Moore.

As assistant director under the three above named directors—Frey, Collier and Hochuli—was the "field marshal" of marketing, Paul A. Best, whose oil industry experience included a tour as branch sales manager in the Bombay province of India for California Texas Oil Co., and later as sales manager both in Long Beach, Calif., and in Seattle. "Field Marshal" Best was a unique personality in OPC-PAW in that he not only had his fingers on everything that was happening in his division; he not only had frequent "tours" as acting marketing director, in the absence of his bosses, but he knew what was going on, and often in quite some detail, in most of the other divisions. Largely, this was due to his ability to make friends inside and out of his own sphere of influence. In the past two years, Mr. Best has been Lt. Best, working with the Navy in oil both on the European continent and in the South Pacific. He is now back in the states, from his latest assignment on Saipan.

The marketing problems of the oil industry were many, and aside from the famed L-70 limitation order, there was probably none that caused more furor than the famed M-68-C, aimed at handling priorities on equipment and materials for oil marketing. The order limited the use of equipment and banned the expansion of any "stationary facilities." Its ramifications are legend and the best thing about it, all marketers will agree, is that the end of the war tossed it out the window.

Relatively early in this oil agency's history, Dr. Frey became a special assistant to Mr. Davies, a position he's retained ever since, working on highly-complicated problems, and his last one is none the less complicated. It's to compile a complete history of the OPC-PAW relations, with industry and government. This history, complete in every

detail, and in every district around the country, is for the archives—and undoubtedly will be dusted off if and when there is another war—and provided that the first atomic bomb, or a reasonable facsimile, doesn't shatter the archives into dust. At any rate, it's a tremendous task, and chances are that "Doc" won't have to worry about another assignment for quite some time.

Quite by coincidence the first and the last recommendations (the last being No. 80) dealt with marketing problems, No. 1 being on gasoline curtailment and No. 80 being on asphalt restrictions. Between this vast gap were many that directly and indirectly affected marketing problems, but this probably is Doc Frey's territory, and for those interested, the "Frey Compendium" is recommended.

OPC's transportation division was also heavily burdened, and long before the supply division was merged, making it the Supply and Transportation Division, it had six separate sections including appraisal, inland waterways, tanker, pipelines, rail and truck. The men who worked in these sections were many and an effort has been made to include the names of all in the list of names which accompanies this article.

Problems of the "Big" and "Little Big" pipelines were transportation's greatest headaches, but helping them (or hindering, depending on one's viewpoint) was the RFC, not forgetting that War Emergency Pipelines built and operated the two giants.

MAJ. J. R. PARTEN HEADED TRANSPORTATION

Probably the most colorful man to head the transportation division was Maj. J. R. Parten, from Premier Oil Refining Co., Texas. He succeeded H. A. Gilbert who was moved up to a special assistant. Major Parten was a favorite Congressional witness, due largely to his charming manners as a gentleman from the "old school." In short, he knew how to handle the boys on Capitol Hill. George A. Wilson, from Louisiana Standard's legal division, fell heir to the directorship when Major Parten left, and characteristically enough is a fiend for facts and figures.

Allan H. Hand, formerly of the Union Oil Co. of California, was, for a short time after transferring from OPA, OPC's assistant transportation director, but his executive talents were needed by PIWC where he took over the reins as executive secretary-treasurer, an office he's ably conducted ever since, under the leadership of William R. Boyd, Jr., PIWC chairman and president of the A.P.I. The vital wartime role played by Mr. Boyd will be expanded in a later article.

While not wishing to engage in any academic argument as to whether the "Big" and "Little Big" pipeline twins constituted a more severe headache than the famed Directive 59, the latter was also, much more than less, a "baby" of the transportation division. Some of the events leading up to its adoption have never before been published, and while names will be deleted in this discussion, the preliminary steps were interesting and they were formulated by oil men in the top echelons.

ACTS TO SPREAD SUPPLY

Briefly, Directive 59 set up certain zones in District 1 into which petroleum products were shipped, in such a manner as to spread the supply among various distributors, based upon their relative market positions.

At a two-day meeting in Washington, Sept. 15-16, 1942, with Administrator Ickes and Deputy Administrator Davies, the remarks which were exchanged were both studious and vitriolic. A tremendously vital problem was being discussed, a problem which at least one major company executive believed would lead "directly to a socialized oil industry." Another oil man saw this meeting as "a parting of the ways" — between government and oil industry cooperation.

After considerable discussion about the loss of brand names which was thought to be an inevitable result of Directive 59, one famous oil company president, long a leader in the field, had this in effect, to say:

"We know that sooner or later we must face the facts and make this wartime transportation delivery system as economical as possible. I don't like the socialized features of it any more than anyone, but are we going to refuse to cooperate because some of us here in this room objects to not having his name on the tank wagon that delivers the oil to his customers? Just what in hell is the difference under the present conditions? I will be perfectly willing for any of you, who are my competitors in normal times, to drive to my customers with your name on the tank wagon—if that means getting the necessary supply to the customer.

"As for myself, at this time, I have no desire to take anybody's business away from him, but it occurs to me that we can do this thing voluntarily, if we get together and endeavor to do it."

This was the type of teamwork that gave PAW its reputation for getting things done.

Later in this same meeting, another top-ranking oil executive expressed his fear of socializing the industry, if Directive 59 was adopted, but he added, in substance:

"I don't see how we can have an efficient handling of the transportation system all the way through unless we inevitably come to commingling of products, so I'm willing to accept it."

Deputy Administrator Davies pointed out that if PAW (then OPC) and the industry didn't work it out on a cooperative basis that possibly OPA or ODT would wield a meat ax and do it anyway, adding, in substance:

"We are trying to adjust the economy of the oil industry sympathetically, and we are trying to do a job that we recognize is a delicate job, and this is not so in some other Washington agencies. For, instead of a delicate instrument, you'll find a meat ax being used, and we can avoid going under the ax just so long as we keep our own house in order."

Administrator Ickes summed up this far-reaching step being taken by the oil industry in practically these words:

"It has been fortunate for us, and I think for you too that we haven't had to go to someone else and ask him to issue a directive. When we find ourselves in a position susceptible to attack, we take a new position so that to date they may press us back here as they are doing the Russians, but we bulge out somewhere else and hold our ground.

"This is very gratifying, and it is a result that we could not hope for if you were not willing to be open-minded and reasonable, as you always are when you are agreed to what we want." (Laughter followed Mr. Ickes' concluding remarks).

DIRECTIVE 59

So, on Sept. 25, 1942—just nine days after this meeting—the famed Directive 59 went into effect, and with it the beginning of a terrific amount of discussion which hasn't yet been settled in all quarters, for this was the directive which called for the compensation plan to get products into District 1.

Refining was another division that was having, so it figured, more than its share of troubles. From the very first, the increased production of 100 octane gasoline had been a No. 1 problem. And evidence as to how well this was licked is the fact that the output was hiked from about 45,000 bbls. daily in the pre-war years to more than 600,000 bbls. daily at the conclusion of the war.

Also interesting to note, merely as a sidelight, is the fact that the increased aviation gasoline problem was one that Dr. Robert E. Wilson, of Indiana Standard, was trying to push when he was a member of the National Defense Advisory Council.

However, with the increased aviation gasoline production problems, the need for synthetic rubber bounced around to practically every agency in Washington, with OPC-PAW playing more than a minor role.

And in the category of the "now it can be told" story, is the reason for some of the trouble refiners had in getting the necessary construction material which was that a so-called "Manhattan Project" was getting first choice on everything it needed. Today, since the story

Manufacturers of Quality Petroleum Products

DIVISION SALES OFFICES

Boston
New York
Philadelphia
Pittsburgh
Atlanta
New Orleans
Houston
Louisville
Toledo

REFINERIES

New York
Philadelphia
Pittsburgh
Toledo
Cincinnati
Port Arthur
Fort Worth
Sweetwater

of the atomic bomb is well known, many in government and out understand why certain construction material "disappeared", sometimes overnight. It was a case of "now we have it, now we don't," and at that time only a select few knew why the refiners didn't get it.

Refining came to play such an important role in OPC's oil wartime expansion that six major sections were established. They were: aviation gasoline; economics; facilities; operations; process; and technological. The men who staffed these various sections were all highly-skilled technologists on leave from various oil companies.

Out of the production division came the natural gas and natural gasoline division. The problems of both were diverse and the manpower needed to administrate production was necessarily large, calling some of the country's foremost production authorities to Washington.

It's a bit difficult, even now to say much about the foreign division for two reasons, one being the fact that, of necessity, the developments here had to be kept a secret during the war, and the other is because even facts that could have been disclosed, without violating any security regulations, were not forthcoming due to the inborn characteristics of the foreign oil men not to talk. However, it's a known fact that their accomplishments can't be dwarfed by any of OPC's divisions and that their problems were, for the most part, on a much wider scale.

MAX MILLER'S SLOGAN

The oil industry will long remember Max B. Miller, who runs his own company, for the work he did as chief of the refining division's construction section. "Making old things do for new" was the slogan, so to speak, that he had tacked up before his door. And his monthly reports were a feature looked forward to, for many months, by refiners who were tearing their hair trying to get necessary material.

The many problems of OPC's many divisions finally brought about the necessity of establishing five district offices located in the following cities: New York (District 1); Chicago (District 2); Houston (District 3); Denver (District 4); and Los Angeles (District 5). To a great extent these offices, with their own divisions, such as marketing, transportation, refining, and whatever other divisions were necessary, helped to ease the burdens at headquarters in Washington.

Hovering about every division and every single recommendation, directive, petroleum administrative order and petroleum distribution order was a relatively young man and his staff, a man with a somewhat determined look and certainly a drive to get things done. His name: J. Howard Marshall, the legalite of OPC-PAW. The "modus operandi" of Director Marshall's division brought many an admiring "ah" and probably an equal number of unadmiring "ohs" from the oil agency in general and the oil industry at large.

LEGAL DIVISION HAD MANY TOUGH NUTS TO CRACK

But whatever anyone thought of the legal division, it had many a tough nut to crack, for it was up to the lawyers to write the orders before the oil industry would act—and understandably so, for oil men had their fingers burned once, at the hands of the Justice Department, and they were determined "never again." Thus the reason for the D.J.'s "green light" which accompanied OPC-PAW actions.

Director Marshall, with a colorful career as newspaperman, world-traveler, Yale professor, NRA code veteran, and oil lawyer, would provide material for a book. Many of his colleagues and oil men alike, believe that he operated on the Ben Johnson theory that "If you can't out-argue 'em, out-shout 'em." But history will record that he sometimes met his equal in these name-calling "contests." It is a fact that he and his staff burned as much midnight oil as any other single division, and if OPC-PAW had any "unsung heroes" Lawyer Marshall and "his boys" should get a rising vote. His secretary, the comely Dorothy ("Dottie" to practically everyone) drew many an oil man to the Legal Division who had nothing particularly scholarly to talk about, for Dottie's "line" was as good as any she heard, and she probably knew as much about oil as many of the lawyers.

Throughout the life of this oil agency as the "Office of Petroleum Coordinator," things were, despite the degree of cooperation, unsatisfactory. Everyone was sniping away at OPC which couldn't get as much as it wished to get done, because it lacked the necessary authority.

So, Administrator Ickes journeyed to the White House (all of five blocks away) and told his troubles to FDR, who early in August of 1942 wrote asking what needed to be done to place oil under a single agency. Mr. Ickes and his staff knew the answer—but could they put it across?

On Aug. 19 the first draft of an executive order was ready, and it was really all-inclusive, claiming everything for the Petroleum Administration (to be its new name) from price control to crowding such agencies as War, Navy, Bureau of Economic Warfare, WPB et al, right out of the window as far as oil control was concerned.

The first draft was circulated to the 17 agencies directly or indirectly concerned. The Bureau of the Budget did the circulating. Every single agency, except the Treasury, objected and some in rather strong terms. In fact OPA Henderson's answer was so "sulphurous" that had it been shown around, the Bureau of the Budget thought, it would have touched off an explosion such as the capital had never seen or heard of.

Five other "major" drafts were completed until all agencies had been pacified except WPB, OPA, the Army and RFC's Jesse Jones. Oct. 28 brought out another draft. This was approved by all except OPA, which had not been consulted in the interim by OPC because of recognition that this would be futile. This draft included three alternate price provisions to give the oil agency different degrees of control over prices. OPA—and ODT—objected.

On Nov. 17 still another draft was ready, and after having cleared the Justice Department it was sent to the Bureau of the Budget and thence to the White House. FDR wanted to know if this was what the Administrator wanted. Mr. Ickes said not exactly, but under the circumstances it seemed the best he could get.

PAW has functioned under the Dec. 2, 1942, executive order ever since. Prior to that its only authority came from whatever WPB delegated it to do.

DIRECTIVES GET 'TEETH'

With the new order, many recommendations and directives were re-written to conform with the new power. For the first time, the government oil agency had "teeth" to its directives. But, as was pointed out early in this article, it never had any enforcement agency—and in that the government-industry oil team worked, both government and industry are high in their praise of each other.

Just prior to the issuance of the executive order creating PAW, OPC (with its consequent lack of authority) had been trying to convince OPA's Henderson and WPB's Nelson of the absolute necessity of a gasoline and fuel oil limitation order, as essential to control the flow of product from suppliers. Henderson had long objected. However, with its new power, Petroleum Administrative Order No. 1 was issued, limiting the amount of motor fuel and fuel oils which could be drawn from primary supply points in each of the six zones into which District 1 had been subdivided.

This move put Mr. Ickes in the position of the fencer in Thurber's famed cartoon in which the head of the opponent (this time, Mr. Henderson) goes toppling off, while the victor shouts: "Touche!" It's certain that the self-styled "old curmudgeon" must have chuckled at final results.

Nothing has been said, to this point, of the work done by the OPC-PAW public relations division, yet there was hardly a recommendation, directive or order of any type that the ex-newspaper

and trade publication men didn't have something to do with, either in interpreting legal language into the layman's tongue, or going into considerable detail over a certain point for some particular publication.

Moreover, it's certainly no secret that the public relations division wrote the vast majority of speeches, radio broadcasts, Congressional reports, and articles for publications. Rarely was there an official who preferred to write his own, Indiana Standard's Bruce K. Brown being one of the few exceptions.

This division, first headed by H. A. Yocom, was later taken over by Gordon Sessions who relinquished the post on being transferred to the Petroleum Reserves Corp. The Oil Weekly's Spencer Robbins then took over for a while, with the Interior Department's Ludwig Caminita winding up affairs. Throughout the change of directors, the pressure was always great and the difficulty of finding qualified men remained a problem. However, it's generally conceded that all in all, it was a job well done.

Wider margins, questionnaires, and other subjects of interest to oil marketers were discussed by PAW leaders, in meeting of which the above, pictured in April, 1943, is typical. Here oil marketers met with Dr. John W. Frey of PAW, center foreground. Left to right around the conference tables are: Paul R. Kempf, Staebler-Kempf Oil Co.; John Downing, PAW; R. H. Collacott, OPA; Leslie Neal, Neal Oil Co.; Robert L. Clark, Safety Service Stations; Fred W. Werlihy, Power Oil Co; John Harper, Harper Oil Co; F. L. Bond, Southeastern Oil Stores; Ralph Brandon, Brandon Oil Co; A. W. Roth, E. & R. Independent Oil Co; H. L. Thatcher, Thatcher Oil Co; W. L. Tyndall, Schock Independent Oil Co; Clyde E. Wallingford, Ohio Petroleum Marketers Assn.; E. F. Battson, Continental Oil Co; John D. Gill, Atlantic Refining Co; Katherine Hunsaker, Dr. Frey's secretary; C. W. Grenz, OPA; D. J. Shannon, OPA; Fred E. Bergfors, Quincy Oil Co.

Oil Industry Salutes Those Who Served in PAW—the War's Best Civilian Job

OFFICE OF DEPUTY ADMINISTRATOR

RALPH K. DAVIES, Standard Oil of Calif., Deputy Administrator, June 1941—
ROBERT E. ALLEN, American Petroleum Institute, Asst. Deputy Admin., June 1941-December, 1943
BRUCE K. BROWN, Standard Oil of Ind., Asst. Deputy Admin., Nov. 1941-December 1944
E. LEE DE GOLYER, DeGolyer, MacNaughton & McGee, Asst. Deputy Admin., July 1941-Sept. 1943
HERBERT C. IDE, Standard Oil of Calif., Executive Asst. to Deputy Admin., Aug. 1941—
EDMUND W. LITTLEFIELD, Standard Oil of Calif., Asst. to Deputy Admin., June 1943—
MAX W. BALL, Special Asst. Dec. 1943—
CHARLES J. DEEGAN, Continental Oil Co., Petroleum Tech., Oct. 1941-April 1944
LOUNSBURY S. FISH, Standard Oil of Calif., Dir. of Organizational Planning, March 1943-June 1944
JOHN PAUL FRANK, U. S. Supreme Court, Spec. Asst. to Pet. Admin., July 1943-June 1944
WIRT FRANKLIN, Independent Producer, Spec. Field Asst. to Deputy Petroleum Admin., Aug. 1941-March 1944
JOHN W. FREY, Interior Dept.'s Petroleum Conservation Div., Spec. Asst. to Deputy Admin., Aug. 1941—
GEORGE M. FULLER, Richfield Oil Corp., Spec. Asst., May 1943
SHERIDAN P. GORMAN, Maritime Commission, Head Industrial Spec. Asst. Deputy Admin., Aug. 1943-Sept. 1943
FREDERICK H. HARBISON, University of Chicago, Labor Manpower Counselor, March 1943-July 1944
PAUL HOLDER, McCann-Erickson, Special Consultant, Dec. 1942-Dec. 1944
ADOLPH H. LEVY, Petroleum Lawyer, Special Asst. to Deputy Petroleum Admin., Nov. 1941—
J. HOWARD MARSHALL, Pillsbury, Madison, Sutro, Asst. Dep. Adm., July 1941-Oct. 1944
ROBERT L. MINCKLER, General Petroleum, Director of Petroleum Sup., Feb. 1942-June 1943
OTTO MERRILL SMITH, Shell Oil Co., Social Econ., May 1945-Aug. 1945
JOSEPH E. WESTENBERG, U.O.P., Senior Process Engineer, Sept. 1941-Feb. 1942
JOHN H. THACHER, JR., Standard Oil of Calif., Executive Secretary, Dec. 1942-Dec. 1944
ELMER J. THOMAS, Consulting Petroleum Economist, Spec. Asst. to Deputy Petroleum Admin., Oct. 1941—June 1943
GEORGE S. WALDEN, Standard Vacuum, Special Representative, Aug. 1943-June 1944
GEORGE W. HOLLAND, Interior's Petroleum Conservation Div., Spec. Assistant to the Deputy Administrator, Aug. 1941-March 1945
ELMER E. BATZELL, Norman L. Meyers Co., Spec. Assistant to the Deputy Administrator, Aug. 1941—
CHARLES B. GALE, Spec. Assistant to the Deputy Administrator, July 1942-Sept. 1945
GEORGE L. KILLION, Calif. Finance Office, Spec. Assistant to the Deputy Administrator, Aug. 1943-Sept. 1944
KARL P. WIRTH, Manpower Specialist, Oct. 1943-Oct. 1945

CONSTRUCTION DIVISION

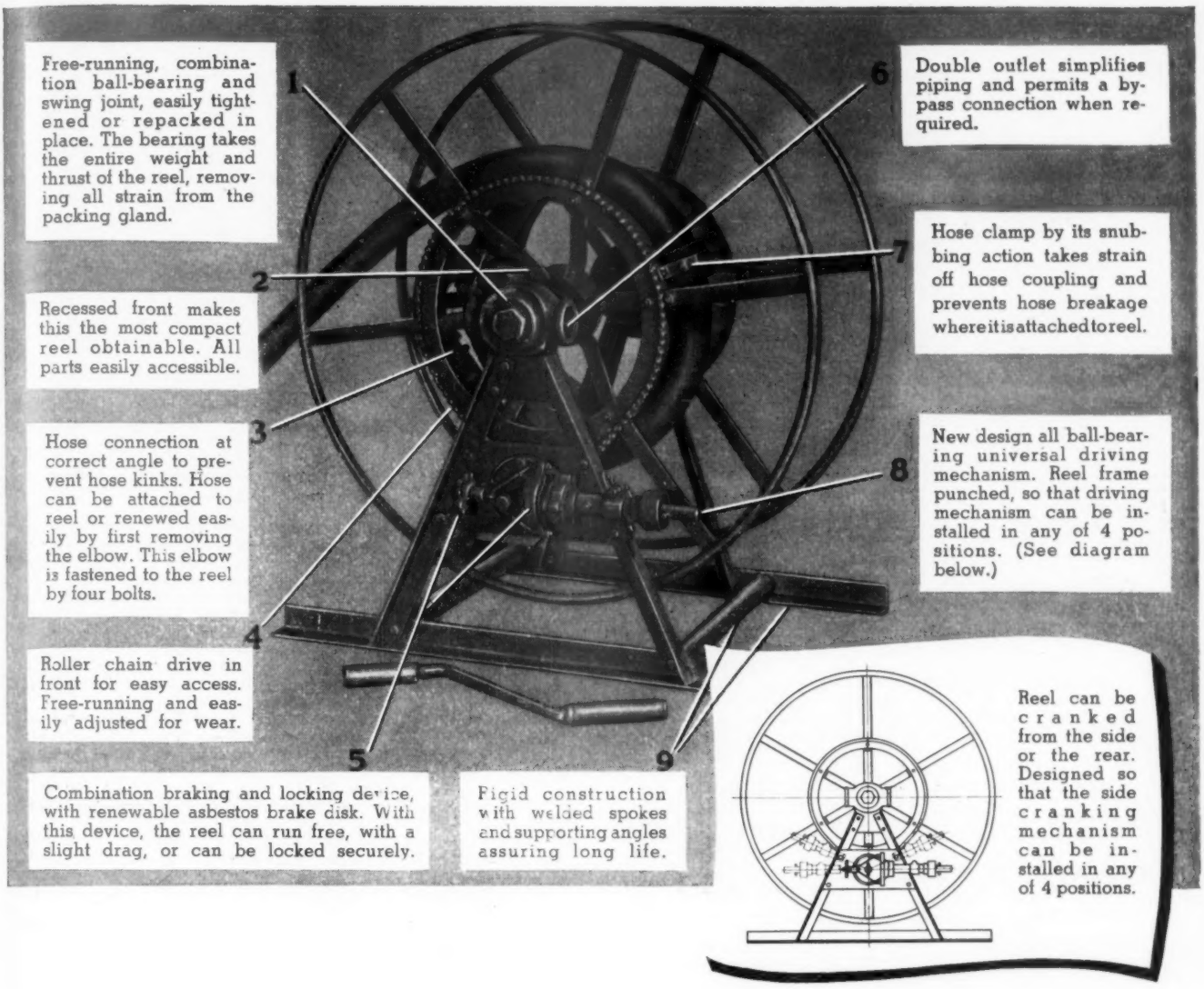
GEORGE GIBSON, Hancock Oil, Director, Sept. 1941-Oct. 1945
MAX B. MILLER, Max B. Miller Co., Inc. Refining Consultants, Director, April 1942-Sept. 1944
M. BROOKS FITZGERALD, Standard Oil of N. J., Asst. Director, May 1942-March 1945
HOWARD CLARK GOODMAN, Pittsburgh Equitable Meter, Chief, Emergency Rating Sec., Oct. 1942-Nov. 1943
JAMES E. HUGHES, Sinclair, Chief, Pressure Vessel Sec., July 1942-July 1944
MYLON C. JACOBS, Chaplin Valve Mfg. Co., Chief, Valves & Fittings Sec., Oct. 1942-Aug. 1944
E. E. KERNS, Ohio Standard, Chief, Pump Sec., Jan. 1943-April 1944
ROY P. WILSON, Sinclair Ref. Co., Chief, Priorities Sec., June 1942-Aug. 1944
CLAUDE V. MARKS, Sun Oil Co., Chief, Redistribution Sec., June 1942-Aug. 1944
JOHN H. MURRELL, Shell Oil Co., Conservation Engineer, Sept. 1941-Oct. 1943
JAMES H. HALL, Texas Co., Special Assistant, Sept. 1941-July 1942

DISTRIBUTION AND MARKETING DIVISION

ROBERT T. COLLIER, Shell Oil Co., Director, July 1942-Feb. 1943
WALTER HOCHULI, The Texas Co., Director, April 1943-Aug. 1945
PAUL A. BEST, The Texas Co., Asst. Director, July 1941-March 1943
JOHN DOWNING, Kentucky Standard, Asst. Director of Marketing, Dec. 1942-June 1943
ROGER M. WILKINSON, Socony-Vacuum, Asst. Director, Aug. 1943-Sept. 1945
DENNIE C. ARNOLD, The Texas Co., Chief, Asphalt Sec., Feb. 1942-Sept. 1944
HOWARD COOPER, Sinclair, Chief, Lubes & Containers Sec., April 1942-Aug. 1945
KENNETH DARLING, Socony-Vacuum, Chief, Fuel Oil Sec., Feb. 1943-Nov. 1944
CHARLES R. DENIS, Gulf Oil, Chief, Fuel Oil Sec. Marketing Div., Sept. 1941-Feb. 1942
JOHN H. DOCKENDORFF, T A D Jones, Chief, Fuel Oil Sec. Marketing Div., Nov. 1942-Dec. 1942
JOSEPH H. ELLENDER, Lehman Corp., Chief, Economics & Analysis Sec., Dec. 1941-Aug. 1945
NED F. FOULDS, New England Fuel & Ice, Chief, Fuel Oil Sec., Aug. 1941-April 1944
CHARLES W. GRENZ, Sinclair, Price Specialist, June 1943-Jan. 1945
ALFRED J. HOCKING, The Texas Co., Chief,

Every Effort Made to Obtain Complete Roster of PAW

Every effort has been made to compile here a complete list of those who served in administrative capacities in the Office of the Petroleum Co-ordinator and its successor, the Petroleum Administration for War. Official PAW files were used as a foundation, then the list was checked several times. There may be, however, a few omissions and errors due to the virtual impossibility of making a completely accurate check upon nearly 500 persons who were active in OPC and PAW during the four years that constituted one of the most hectic periods in America's history.


1
Free-running, combination ball-bearing and swing joint, easily tightened or repacked in place. The bearing takes the entire weight and thrust of the reel, removing all strain from the packing gland.
2
Recessed front makes this the most compact reel obtainable. All parts easily accessible.
3
Hose connection at correct angle to prevent hose kinks. Hose can be attached to reel or renewed easily by first removing the elbow. This elbow is fastened to the reel by four bolts.
4
Roller chain drive in front for easy access. Free-running and easily adjusted for wear.
5
Combination braking and locking device, with renewable asbestos brake disk. With this device, the reel can run free, with a slight drag, or can be locked securely.
Rigid construction with welded spokes and supporting angles assuring long life.
6
Double outlet simplifies piping and permits a by-pass connection when required.
7
Hose clamp by its snubbing action takes strain off hose coupling and prevents hose breakage where it is attached to reel.
8
New design all ball-bearing universal driving mechanism. Reel frame punched, so that driving mechanism can be installed in any of 4 positions. (See diagram below.)
9
Reel can be cranked from the side or the rear. Designed so that the side cranking mechanism can be installed in any of 4 positions.

The New Hose Reel You Have Been Looking For

COMPACT, RUGGED, LIGHT IN WEIGHT, BALL-BEARING CONSTRUCTION THROUGHOUT

The New Philadelphia Valve Co. reel is the finest reel built. It is compact, rugged, and light in weight. All parts are of steel, malleable iron, or bronze; no cast iron is used. It is ball-bearing throughout with hardened and ground races. (6 ball bearings are used.) It will never wear out.

The reel can be changed from top winding to bottom winding by reversing the hose connection and rotating the drum. All working parts and hose connections are in front and easily accessible. It is light in weight, a reel that holds 100 feet of 1½" hose, weighs only 93 pounds.

We can furnish hose reels in any size or shape. They can be furnished for installation either in bucket box at rear of truck or in underslung box on side of truck. Give inside dimensions of box when writing for information. Special reels can also be furnished for Airfield Refueling Pits and Ship Docks.

Delivery can generally be made in a few days after receipt of order. For sizes, prices, and dimensions, write for Catalogue No. 165.

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A PROGRESSIVE DEALER MUST KNOW WHAT HIS CUSTOMERS WANT

To get the answer Shell asked 180,000 Motorists—40,000 gave their answers

Here are two of the questions asked:

1. "Supposing your car obviously needed: Fresh gear lubes—New wiper blades—Fan belt—Would you expect your dealer to tell you about it?"

2. "Every time you drive into your service station (today), do you expect your Shell dealer to . . .

   a. Check your motor oil?
   b. Check the water in the radiator?
   c. Wipe your windshield?
   d. Check the tires?"

For the answers to these and 91 other important questions—ask the Shell representative in your town.

This is the kind of information Shell is getting for its future planning to serve Shell Dealers.

SHELL

SHELL OIL COMPANY, Incorporated

High ranking Army, Navy and government officials in Washington, worked closely with PAW on the 100-octane aviation gasoline program. Above is a scene at a meeting in July, 1944, at a time when there was a cry for "more and more high octane aviation gasoline". Shown in the picture are, left to right, seated, Air Marshal Sir William L. Welsh of the R. A. F.; PAW Chief Ickes; Gen. H. H. Arnold. Standing: H. Wilkison, British petroleum representative; Deputy PAW Davies; Harry G. Burke, jr., chairman of the Aviation Gasoline Advisory Committee of PAW; and Admiral DeWitt Ramsey, Chief of Bureau of Aeronautics, U. S. Navy. The refiners were sobered by the staggering demands, but they were met

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WAYNE A. HOWARD, Prin. Spec. Refinery Proc., Nov. 1942-March 1943
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HUGH E. LUFFMAN, Humble Oil & Ref. Co., Econ. Anal., June 1944
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LEWIS E. REARD, Union Oil of Calif., Commercial Cost Account, Dec. 1943-July 1944
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HAROLD STILES, Specialist, Feb. 1942
KENNETH LEW STONE, Tariff Commission. Comm. Cost Account, April 1943-June 1944
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EARL WHATLEY, Socony-Vacuum, Chief, Military Supply Sec., Feb. 1943
BOYD WILSON, Pennsylvania Railroad, Chief, Scheduling Officer Spec. Asst. to Director, Dec. 1941-Jan. 1944
JOSEPH WINTERBERGER, Gulf Oil Corp., Chief, Tanker Sec., Oct. 1941—
HERBERT S. AUSTIN, Iranian Pipeline Project, Consultant on Pipe Lines, Feb. 1942-July 1942
ROBERT E. FRIEDMAN, Interior Dept., Spec. Asst. to Director, Nov. 1943
GEORGE W. GOAD, Pipeline Operations Sec., Nov. 1943
HOWARD T. MATHER, Louisiana Standard, Spec. Asst. to Director, Aug. 1941-Sept. 1944
HOMER LEROY ARMSTRONG, Skelly Oil Co., Transp. Economist, May 1942—
JOHN E. BOICE, I.C.C., Pipe Line Consultant, June 1942
EDWARD G. DENNISTON, Socony-Vacuum, Ind. Spec. (Pet. Pr. Supp. Coord.), Aug. 1942—
JERMIAH F. MCCARTHY, Pipe Line Consultant, Jan. 1943-March 1944
C. L. HARDING, Socony-Vacuum, Director in charge, Jan. 1942-June 1943
PAUL J. BUTLER, Sinclair Ref. Co., Director, Supply & Transp. Div., Nov. 1943—
LAURENCE B. DAVIS, Socony-Vacuum, Director of Marketing, Aug. 1942-June 1943
R. M. DINGES, Continental Enisco Co., Director of Materials, Feb. 1942-March 1945
WILLIAM C. EBERLE, Atlantic Refining, Director of Transp., Dec. 1941-Aug. 1943
FRANK A. EPPS, Spartan Oil Co., Director, Facility Security, Sept. 1942-June 1945
CARLETON J. EVERETT, Standard Oil of N. J., Director of Refining, June 1945-Sept. 1945
JOHN HARPER, Harper Oil Co., Director, Distribution & Marketing Div., June 1945—
EDWARD H. KARES, Standard Oil Development, Director of Construction, Aug. 1943-Dec. 1943
WILLIAM D. MANGAN, Socony-Vacuum, District Counsel, Jan. 1945—
WILLIAM NADEN, Standard Oil of N. J., Director of Refining, Jan. 1944-July 1944
DE LLOYD D. NASH, Standard Oil Dev. Co., Director of Construction, Jan. 1944-Nov. 1944
FRANK S. PROCTOR, Standard Oil Dev. Co., Acting Director, Facility Security, Aug. 1945-Sept. 1945
LEE VAN ROBERTS, Shell Oil Co., Counsel, May 1943-Oct. 1944
PIERCE B. WATSON, Royal Petroleum Corp., Acting Director, Supply July 1943-Nov. 1943
GEORGE F. WILL, Shell Oil Co., Director of Materials, June 1945-Sept. 1945
JAMES R. WYLIE, JR., Hanley & Hunley, Director of Production, July 1941-July 1945
VIRGIL F. BOWYER, Peoples Natural Gas Co., Asst. Director of Nt. Gas & Nat. Gasoline Div., Jan. 1942-March 1943
GERARD R. TORBORG, Pan American Petroleum, Asst. Director of Supply & Transportation, Dec. 1942-April 1944
NORVAL E. BAKER, Jersey Standard, Principal Analyst Foreign Div., Feb. 1942-March 1944
EMERSON M. BUTTERWORTH, Standard Oil of Calif., Spec. Representative Foreign Div., Feb. 1942-March 1944
J. E. KLEEMAN, Gulf Oil Co., Spec. Asst. to Director, Dec. 1944—
R. W. MCCOLLUM, Zone Representative, Dec. 1943-Oct. 1945
REED PROUTY, Gulf Oil Corp., Zone Representative Feb. 1943-Oct. 1945
HENRY J. RODRIGUEZ, The Texas Co., Spec. Asst. to Director, June 1943-June 1944
JOHN H. SCHOONMAKER, Socony Vacuum, Zone Representative, Feb. 1943-Nov 1943
MAC LEAN ULRICH, Standard Vacuum Co. of N. Y., Petroleum Technologist Foreign Div., Nov. 1945
NORRIS G. WOOD, Standard-Vacuum, Spec. Representative, July 1944-Aug. 1945
THOMAS F. MCCAREY, Petrol Corp., Director of Marketing, May 1942-Dec. 1942
LOUIS H. SPINER, Laclede Gas Co., Director of Marketing, Aug. 1941-June 1942
HERMAN B. VAN CLEVE, Maritime Petroleum Corp., Asst. Director of Marketing, Oct. 1942-April 1943
FRANK M. BREWSTER, Director of Nat. Gas & Gasoline, Jan. 1942-Dec. 1943
CHARLES S. ALLEN, Asst. to Director, June 1944-Dec. 1944
EARL C. EASTMAN, Standard Oil Development Co., Asst. Director of Facility Security, Oct. 1942-Nov. 1944
MARK ANTON, Self-Employed, Chief, Fuel Oil Section, July, 1941-Aug. 1944
JOHN D. COLLINS, Tide Water Associated Oil, Director in Charge, June 1944-Jan. 1945
HENRY W. DODGE, The Texas Co., Director in Charge, April 1943-June 1944
WILLIAM CLARK DAFFRON, Asst. to Director (Public Relations), April 1944
EDWIN W. ESMAY, P.I.W.C., Asst. to Director, (Public Relations), Sept. 1943-March 1944
WARREN W. BURNS, Nat'l Petroleum News. Asst. to Director (Public Relations), Sept. 1942-July 1943
JAMES P. PATTERSON, Standard Oil of Indiana, Director of Transp., Aug. 1943-Jan. 1944
CHARLES A. LOCKARD, Asst. Director of Marketing, Dec. 1941—
LAWRENCE L. ANDERSON, Standard Oil of N. J., Prin. Petroleum Techn., March 1943-Sept. 1944
BENJAMIN J. LANE, Asst. Dist. Counsel, Jan. 1943—
HENRY M. NOEL, Standard Oil of N. J., Petroleum Specialist, Feb. 1943-Nov. 1944
HAROLD SYDNOR, Aviation Techno. Jan. 1942-Nov. 1943

DISTRICT TWO

EDWARD J. BULLOCK, Indiana Standard, Director in Charge, Oct. 1942-Oct. 1945

W. W. VANDEVEER, Allied Oil Co., Director in Charge, July 1943-Nov. 1944
CHARLES J. ALBERDING, Universal Oil Products Co., Director of Refining, March 1943-Oct. 1945
PAUL J. BOND, The Pure Oil Co., Director of Supply & Transp., April 1942-March 1945
CHARLEY C. BROWN, Director of Production, Jan. 1942-Oct. 1945
PHILIP D. DENTON, Sinclair Ref. Co., Asst. to Director, May 1943-Dec. 1944
WALTER DU MONT, Pure Oil Co., Director of Transp., Aug. 1941-July 1943
ERNST J. FRUEH, Shell Oil Co., Director of Supply & Transportation, May 1944-Oct. 1945
SETH W. HERNDON, Buehl-Herndon Drilling Co., Director of Nat. Gas & Nat. Gasoline, Sept. 1942-July 1943
LOYAL B. HOLLAND, Director of Materials, April 1942-Sept. 1945
ERNEST L. HUGHES, Hughes Oil Co., Director of Distribution & Marketing, Nov. 1942-Sept. 1944
CARROLL W. JOHNSON, Pure Oil, Director of Marketing, Oct. 1942-Aug. 1943
RAYMOND B. KELLY, The Pure Oil Co., Director of Production, Aug. 1943-Feb. 1944
JAMES W. LIDDELL, Continental Oil Co., Director of Supply Div., Aug. 1943-Jan. 1944
HARRY W. NANKERVIS, Drixle Distributors, Inc., Director of Distribution & Marketing Div., Aug. 1943-Sept. 1945
MARK S. PATTON, Hurley Gasoline Sales Co., Director of Nat. Gas & Natural Gasoline, May 1942-Dec. 1944
CHARLES K. SCHWARTZ, Gottlieb & Schwartz, District Counsel, Nov. 1941-Dec. 1943
FANER C. WONDERLY, Private attorney, District Counsel, May 1943-Oct. 1945
CHARLES P. HOLMES, Oklahoma Inspection Bureau, Asst. Director of Facility Security Div., Nov. 1942-Sept. 1945
MARSHALL R. JOY, Petroleum Advisors, Inc., Asst. Director of Production Div., June 1944-Sept. 1945
MARK KIRKPATRICK, The Pure Oil Co., Asst. Director of Supply & Transp. Div., Feb. 1945-Sept. 1945
HARRY V. KLUG, Asst. Director of Materials Div., Nov. 1942-Sept. 1944
IRWIN E. LAMP, The Pure Oil Co., Asst. to Director, March 1945-Sept. 1945
ROBERT B. NEWCOMBE, JR., Consulting Geologist, Asst. Director of Production, Aug. 1941-April 1944
JOHN E ROUSE, Standard Oil of Indiana, Chief, Process Sec. Refining Div., July 1943-July 1945
JOHN F. SWAB, Reed & Swab, Asst. Director of Nat. Gas & Nat. Gasoline, Nov. 1942-Sept. 1945
JOHN ARCH TURNER, O.D.T., Asst. Director of Supply & Transp., May 1942-June 1945
H. L. WADSWORTH, Associated Petroleum Co., Asst. Director of Production Div., Aug. 1941-Aug. 1943
EARL PETTY, ALCO Products, Director of Refining, Aug. 1941-Sept. 1942

DISTRICT THREE

W. M. AVERILL, Director in Charge, May 1942-Sept. 1945
DARST E. BUCHANAN, Hanlon & Buchanan, Director in Charge, Jan. 1942-Nov. 1943
HENRY M. BROWN, Midland Gasoline, Director of Nat. Gas & Nat. Gasoline Div., Sept. 1943-March 1945
E. O. BUCK, Gas Laboratories, Inc., Director of Production, Aug. 1941-April 1943
DUDLEY CORNELL, A.P.I.C. (New Mexico), Dist. Counsel, Sept. 1942-Sept. 1945
EDMUND J. DORGAN, JR., Pan American Pet. Co., Director of Marketing Jan. 1943-Aug. 1944
KRAUS EARHART, The Texas Co., Director of Facility Security Division, Nov. 1942-Sept. 1945
ALLEN B. GIBSON, Director of Production, Oct. 1944-Sept. 1945
GRADY VAUGHN, G. H. Vaughn Production Co., Director of Production, Aug. 1941-Oct. 1942
JAMES H. GRAHAM, Ell-Mar Oil Co., Dist. Director of Nat. Gas & Nat. Gasoline Div., Nov. 1942-Sept. 1945
GORDON T. GRANGER, Bareco Oil Co., Director of Refining, Aug. 1941—
DAVID G. GRAY, North Texas Oil & Gas Assn., Director of Marketing, Feb. 1942-Aug. 1942
SAM H. HARPER, The Pure Oil Co., Director of Materials, July 1945-Sept. 1945
FRANK L. HEREFORD, Murray Brashe Hardware Co., Director of Materials, May 1942-Dec. 1942
HARRY LEYENDECKER, Tydol, Director of Supply & Transp. Div., Feb. 1942-Sept. 1945
ADRIAN MOORE, Independent Producer, Director of Production, April 1943-March 1944
WM. J. MURRAY, JR., Texas Railroad Commission, Conservation Engineer, Oct. 1941-Feb. 1944
C. EDWARD NAYLOR, Maintenance Engineering Corp., Director of Materials, Jan. 1942-March 1944
GEORGE SAWTELLE, Kirby Petroleum Co., Director of Facility Security Div., Aug. 1942-Feb. 1943
ROBERT V. SHIRK Tulsa Executives Assn., Manpower Counselor, Jan. 1943—
DEE P. STURGES, Cities Service, Director of Construction, Aug. 1943-July 1944
GLENN P. THOMPSON, Texas Railroad Commission, Director of Distribution & Marketing, Dec. 1941-June 1945
JAMES B. THOMPSON, Shell Pipe Line Corp., Director of Materials, Jan. 1944-Feb. 1945
EDWIN A. WAHLSTROM, Goldsmith Pool Engineering Committee, District Dir. of Prod., June 1944-April 1945
ROBERT L. CARRUTHERS, Hughes Tool Co., Asst. Dir. of Production, Jan. 1943-Aug. 1944
J. AUBREY BONHAM, Union Sulfur Co., Asst. Dir. of Materials, Nov. 1942-Oct. 1943
RICHARD L. COCHRAN, C. K. Drilling Co., Asst. Dir. of Materials, June 1942-Sept. 1945
B. G. MARTIN, Gulf Oil, Chief of Conservation, Jan. 1942-July 1944
MANNING L. MAYFIELD, Cotton Valley Operators, Asst. Dir. Nat. Gas. & Natural Gasoline Div., Feb. 1942-May 1944
LOUIS I. MISTROT, Consolidated Vultee Aircraft, Asst. Director of Nat. Gas & Nat. Gasoline Div., Sept. 1943-Sept. 1945

DISTRICT FOUR

MICHAEL J. FOLEY, Interior Dept., Director in charge, Oct. 1941-Nov. 1945
ALBERT M. BALLARD, Director of Nat. Gas & Nat. Gasoline Div., April 1942-March 1944
JOHN R. FANSHAWE, II., Ohio Oil, Director of Reserves, Nov. 1942-March 1944
FRANCIS C. FOGARTY, Home Oil & Ref. Co., Director of Supply & Transportation, April 1944-Oct. 1945
EDWARD A. MARKEY, Continental Oil Co., Director of Refining, June 1943-Oct. 1945
WILLIAM K. PHILLIPS, Sherwood Brothers, Director of Distribution & Marketing, May 1942-Aug. 1945
HERBERT T. RAPP, Rapp Oil Co., Director of Marketing Aug. 1942-Oct. 1943
JOHN B. SCHUYLER, Hillman Kelly Co., Director of Materials, Jan. 1942-Sept. 1945
LOUIS G. WILKE, Phillips Petroleum, Director of Distribution & Marketing, Nov. 1943-Feb. 1945
JOSEPH J. ZORICHAK, Stanolind Oil & Gas, Asst. Director of Prod., Jan. 1942-Sept. 1945

DISTRICT FIVE

HERBERT R. GALLAGHER, Consolidated Oil, Director in Charge, Jan. 1943—
RUSSELL R. PALMER, Petroleum World, Asst. to Dir. in Charge, Sept. 1943—
HOMER E. BRITZMAN, Dist. Dir. of Marketing, Jan. 1942
CHARLES E. HEYNS, Pacific States Oil Co., Dist. Dir. of Marketing, March 1942-March 1945
CHARLES B. GARRETSON, Dist. Dir. of Marketing
EUGENE L. DAVIS, The Texas Co., Director of Production, Dec. 1941-May 1945
WENTWORTH H. OSGOOD, California Oil Umpire, Director of Production, March 1941-Oct. 1941
ROLAND G. WHEALTON, M. O. Johnson Oil Fields, Service Corp., Director of Production, Sept. 1942
CARLTON BEAL, Richfield Oil Corp., Asst. Dir. of Production, July 1945—
ALEX J. DIEPENBORCK, The Petrol Corp., Asst. Dir. of Production, Feb. 1942—
LEWIS E. FLEMING, Standard Oil of Calif., Dir. of Sup. & Trans., April 1943
S. DALE GIBSON, Asst. Dir. of Sup. & Trans., Dec. 1941—
HOLLIS B. FAIRCHILD, Standard Oil of Calif., Asso. Dir. of Sup. & Trans. Feb. 1945-April 1945
ARTHUR CHARLES SAUL, Shell Oil Co., Asso. Dir. of Sup. & Trans. July 1944-Feb. 1945
JOE K. STEELE, Eastern Seaboard Petroleum Co., Asst. Dir. of Sup. & Trans., March 1942-Aug. 1945
GEORGE F. PRUSSING, Union Oil of Calif., Director of Construction, Aug. 1942-Jan. 1945
CHARLES T. REICHERT, National Supply Co., Director of Materials, Jan. 1942—
EDMUND JUSSEN, Chica Oil Corp., Asst. Dir. of Production, Dec. 1941-April 1943
KENYON L. REYNOLDS, Independent (Pacific Gasoline Co.), Director of Nat. Gas & Nat. Gasoline, March 1942-July 1945
REED W. GARMAN, Union Oil Co. of Calif., Asst. Dir., Nat. Gas & Natural Gasoline, Dec. 1941—
MALCOLM P. YOUKER, Phillips Petroleum, Director of Refining, Nov. 1942
VERNON W. BALZER, Ford Instrument, Asst. Dir. of Refining, July 1941-May 1944
DONALD W. BOARDMAN, Union Oil of Calif., Asst. Dir. of Refining, Feb. 1942—
EVERETT G. TROSTEL, Union Oil of Calif., Asst. Dir. of Construction, Oct. 1941-March 1945
LAWRENCE C. HAMPTON, Bechtel-McCone-Parsons Co., Chief Materials Specialist, June 1942—
ALBERT I. GREGERSEN, The Texas Co., Dist. Geologist, July 1943-May 1945
LAWRENCE VANDERLECK, Fullerton Oil Co., Director of Production, March 1943-May 1944

ADMINISTRATIVE DIVISION

E. J. SKIDMORE, Interior Dept., Director, Aug. 1942
J. CLINTON YOUNG, Government, Spec. Asst. to Director, March 1943-Aug. 1943
ERIC L. KOHLER, W.P.B., Executive Officer, Dec. 1942-Oct. 1944
WILLIAM H. NEWMAN, U. of Pennsylvania, Executive Officer, April 1944—
STANLEY W. CROSTHWAIT, Executive Officer, July 1941-Aug. 1942

Pure Oil Expanding Carolina Layout, Adding 4 New Plants

Special to NPN

CHARLOTTE, N. C.—The Carolinas division of the Pure Oil Co. has completed plans to build new wholesale plants in Greensboro, Elkin and Charlotte and in Columbia and Easley in South Carolina "as soon as building materials are available."

O. Y. Kirkpatrick, Carolinas division manager, said that plans have been completed for the erection of a number of service stations in Cheraw, Greenville and Charleston in South Carolina and in Greensboro, Wallace, Elkin and Gastonia in North Carolina.

Mr. Kirkpatrick added that plans had been completed to start work in Nov. on modernization of the ground floor of Pure Oil's office building in Charlotte.

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Hunt Oil to Build Asphalt Plant at Tuscaloosa, Ala.

Special to NPN

DALLAS — A new outlet for crude oil from part of the production of the Gilbertown field in Alabama will be provided by a $500,000 asphalt plant which will be built soon by the Hunt Oil Co. of Dallas.

Engineered by the Hudson Engineering Co. of Houston, the plant will be located at Tuscaloosa, and will have a daily capacity of around 3000 bbls., President H. L. Hunt told NPN. Mr. Hunt said his company has from 15 to 20 wells in the field with a daily capacity of around 1500 bbls. The extra capacity in the new refinery will be used to take care of oil from wells Hunt plans to build in the future.

Mr. Hunt said that Gilbertown crude from his wells, which he said was 65% high grade asphalt, had a ready market during the war and was shipped out by rail. When the war ended, however, his contracts were canceled and the wells were shut down. The wells are now operating at about one-half capacity to supply markets found since the war ended.

Work will be begun on the refinery immediately, he said.

Two Shell Plants Receive Highest Awards For Safety

NPN News Bureau

LOS ANGELES—The highest awards ever given to petroleum refineries in the U. S. for outstanding work in accident prevention have been presented to both the Martinez and Wilmington plants of Shell Oil Co., Inc., of California. This is the National Safety Council's "Award of Honor for Distinguished Service to Safety".

The two Shell refineries claim an accident rate less than half the average for other refineries throughout the country. The figures are based on number of accidents and their seriousness as measured by time lost from work in 1944, the year covered by the award.

New Types of Synthetic Lubricants Said to Be Superior in Many Respects to Petroleum Oils

NPN News Bureau

TULSA—New types of synthetic non-petroleum lubricants which are reported to be superior in many respects to petroleum oils were announced here at the Society of Automotive Engineers Fuels and Lubricants Meeting in Hotel Mayo.

The new fluid and grease lubricants were described by T. A. Kauppi and W. W. Pedersen, two engineers with Dow Corning Co., Midland, Mich., as silicone polymers—compounds similar in chemical structure to hydrocarbons but with the usual carbon replaced by silicon (the main ingredient of ordinary sand).

In other talks presented at the opening sessions of the SAE meeting, members of the society were told that high cetane number ratings of Diesel fuels are no longer accurate criteria of their quality, that Diesel fuel additives are creating new concepts of combustion and performance, and that detergent-type lubricating oils prolong the operating life of aircraft engines.

In a paper prepared for presentation before Monday's SAE meeting, the Dow Corning engineers stated that "silicone fluids possess a combination of properties which go a long way toward eliminating some of the problems encountered by the lubrication engineer."

The new lubricants, they claim, are characterized by high resistance to heat, cold and oxidation. Silicone greases and compounds are reported to have demonstrated their ability to lubricate bearings and instruments over a temperature range of 40 degrees below zero to 400 degrees above zero (F.) without great change in consistency.

Silicone fluids were said similarly to resist becoming thin at high temperatures and thick at low, and to approach petroleum oils in lubricating qualities. It was reported that if the temperature of a silicone fluid and of a petroleum oil, each having the same viscosity at 100 degrees F., is reduced to zero, the silicone fluid will have only one-sixth the viscosity of the oil. Some silicone fluids were said to have pour points of 50 to 96 degrees below zero.

Lack Lubricating Qualities in Many Cases

The engineers pointed out, however, that the silicone fluids in many cases lack the lubricating qualities of petroleum oils, even though they are characterized as "perfect lubricants" so far as heat stability, oxidation resistance, and general chemical inertness are concerned.

One silicone fluid, for instance, was reported to surpass petroleum oils for steel-to-brass lubrication at moderate loads, but to be less effective at loads approaching extreme-pressure ranges.

Belief was expressed that silicone fluids will have a substantial range of applications as lubricants, particularly when loads are light or moderate, temperature changes rapid or extreme, and oxidation dangers high. In suming up their report on silicones as lubricants, the Dow Corning engineers stated that:

"Silicone fluids offer possible solutions to lubricating problems involving heat stability, oxidation resistance, nonvolatility and low change of viscosity with change in temperature.

"Different types of silicone fluids vary in their lubricating ability and in their behavior toward various rubbing metal surfaces. Some of the silicone fluids approach petroleum oils in ability to reduce wear.

"Silicone greases, because of their oxidation resistance and low volatility, should find application in the operation of ball bearings under severe conditions and in permanently-lubricated ball bearings where long service life is essential."

The discussions on Diesel engines and fuels were presented in two papers—one by Com. E. F. Griep and Lieut. Com. C. S. Goddin, U. S. Navy Bureau of Ships, Washington, and the other by C. M. Larson, chief consulting engineer for Sinclair Refining Co., New York.

Speaking on "The Significance of Cetane Number in Fuels," Com. Griep and Lieut. Com. Goddin asserted that Diesel engines and fuels are outgrowing their prewar yardstick of cetane number.

"Cetane number," they stated, "is a measure of ignition quality of a fuel. There is evidence, however, that other characteristics indicative of the rate of flame propagation or its burning properties during the combustion phase are of equal importance in Diesel engine performance.

Even with high-speed Diesels of present design, they said, cetane numbers indicate merely the minimum quality of fuel for satisfactory starting and for preventing excessive smoking, combustion roughness, and engine deposits. Supercharged engines and additive fuels will demand new concepts of power output and performance, in their opinion.

Speaking on the effect which Diesel fuel additives have had in creating new concepts of fuel combustion and engine performance, Mr. Larson predicted that a new "Power Performance" or "Service Rating" will take precedent over cetane number. "Diesel index should be dropped entirely," he stated, "where additives are incorporated into the diesel fuels of the future."

Reports Results of Tests

Mr. Larson reported the results of tests in which amyl nitrate was used as a Diesel fuel additive. Satisfactory engine performance may be obtained, he said, on selected low cetane number fuels conservatively doped with the additive.

He declared that by adding 0.07%-vol. of amyl nitrate to Diesel fuel of 44 cetane number, a Diesel engine would

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The report on the detergent-type oils in aircraft engines was prepared by C. O. Tongberg and R. E. Ellis, Standard Oil Development Co., Elizabeth, N. J., and C. H. Baxley, Intava, Inc., New York. Tests made with engines of planes used in British pilot training squadrons were said to indicate that the detergent oils minimize ring sticking, piston skirt and ring zone deposits, and sludge, and thereby extend operating hours.

Many of the improvements to be expected in future reciprocating engines, it was explained, will impose greater burdens upon lubricants, and these the detergent oils appear to be prepared to carry. "The good performance of the detergent oil under high duty, high temperature conditions indicates," they concluded, "that it may be an important factor in future development of improved aircraft engines."

Acetylene from Natural Gas Method in Pilot-Plant Stage

Special to NPN

AUSTIN, Tex. — Operation of a pilot plant large enough to determine actual commercial costs of manufacture is being planned by Dr. E. P. Schoch, University of Texas chemist, as the next step in the development of his method for manufacturing acetylene from natural gas.

Dr. Schoch and his associates since 1929 have been working on the electrical discharge method of making acetylene from methane, but until now they have not had the facilities for manufacturing the product on a sufficient scale to permit cost determinations.

"An all-steel structure, 28 by 28 ft., is being constructed on the campus to house the apparatus," Dr. Schoch said. "The conditions will be exactly as found in all highly competitive petroleum refineries in which various oils or liquids are used to extract constituents from mixtures of gases and to turn the products loose in purer forms. The project at the university is concerned only with gas instead of the oil vapors."

Dr. Schoch said that the technical equipment will include rectification towers, ranging in height from 16 to 32 ft., extraction towers, heat exchangers, heaters, cooling devices, gas compressors and other machinery needed. The final product, pure acetylene gas, will be placed in a large tank from which it will be distributed in commercial containers for testing by individual users, he explained.

Investigations also are under way at the university on the use of electric discharge principle in the production of products other than acetylene, and to improve the efficiency of present process. Along this line, the investigators are studying captured German processing records.

Dr. Schoch stated that the production of 100,000 tons of acetylene from natural gas in Texas would produce products worth $80,000,000 and this would be made from about 20 billion cubic feet of gas—used partly as raw material and partly as fuel.

Personnel of the acetylene division of the Bureau of Industrial Chemistry, headed by Dr. Schoch, includes the following men who devote their full time to the electrical discharge research: W. B. Howard, H. A. Holcomb and A. S. Kasperik, senior chemical engineers; J. L. Weeks, G. E. Montes, K. I. Glass, Max Samfield and J. W. Sheehan, chemical engineers; A. M. Cuellar, Jr., chemical engineer assistant; W. L. Ray, senior chemist; and R. P. Lightfoot, E. J. Claassen and Jack Burks, junior chemical engineers.

Humble Oil Co. Takes Over Big Baytown Ordnance Works

Special to NPN

BAYTOWN, Tex.—The big Baytown Ordnance Works, which provided the "stinger" for at least one out of every two U. S. bombs that fell on enemy territory, has taken its place in the peacetime operations of the Humble Oil and Refining Co.

Here was made one half of the total supply of the U. S. toluene used in the last war, with the plant operating at two and one-half times its originally designed capacity. Today this toluene, which is the final "T" in TNT, is going into more peaceful channels as paint thinner and solvent. Naphthas now are being routed through the Baytown Ordnance Works hydroformer unit, which results in an improved yield of higher octane product than could be obtained by the thermal cracking alone.

The xylenes which came out of Baytown for use in the 100-octane gasoline program continue to go into Humble's peacetime gasoline production.

Humble, after V-J day, resumed operation of the ordnance plant under a 90-day lease agreement with the government, while negotiations are pending on its future disposition.

RFC Puts Avgas and Chemical Plants up for Sale or Lease

NPN News Bureau

WASHINGTON—Reconstruction Finance Corporation is offering for sale or lease the government-built aviation gasoline plant of J. S. Abercrombie Co. and Harrison Oil Co. at Sweeney, Tex., and the Houdry Process Corp. chemical plant at Paulsboro, N. J., which produced alumina silica catalyst used in aviation gasoline.

J. S. Abercrombie Co. and Harrison Oil Co. plant comprises 508 acres in seven land tracts, and contains 29 refinery-type buildings of brick, tile, steel and concrete having a total of 65,000 square feet. The property is adjacent to a two-mile railroad siding.

Houndry's plant occupies 5 3/5 acres, with one building of 38,500 square feet.

Standard (N. J.) Director Says Reserve Will Cover War Losses

NPN News Bureau

NEW YORK—The $105,000,000 reserve Standard Oil Co. (N. J.) set up in 1941 and 1942 will be ample to cover the book value of its war-damaged properties, said Director Robert T. Haslam last week.

Mr. Haslam, who arrived by plane after a two-months tour of Europe, was accompanied by Standard's Co-ordinator for Refining William Haley and Chief Counsel Edward F. Johnson.

Western Hemisphere and Middle East supplies will meet Europe's demands until orderly distribution is restored, the Standard official believed. He said:

"There are enough supplies, but temporarily the lack of shipping space prevents the flow of oil to Europe." However, he added, the oil pool will continue operation for some time and countries with sterling balances will obtain Middle East oil and those with dollar credits will get it from this hemisphere.

No exact estimate of the company's damage in Europe was forthcoming from Director Haslam, who felt it would take from one to three years to get Standard operations in Europe back to normal. Most serious damage he found was Nazi demolition of terminal facilities when they evacuated Rotterdam and Amsterdam in September, 1944.

The tour included properties in Holland, Belgium, France, Demark, Norway, Sweden, England, refineries at Haifa, Palestine. Concerning the latter, Mr. Haslam was enthusiastic about their "efficient job."

Recommends Gasoline Tax Raise For Calif. Highway Program

NPN News Bureau

SAN FRANCISCO—An increase in the gasoline tax to finance an estimated $634,500,000 "critical improvement" program on California highways has been recommended by the State Division of Highways.

The $634,500,000 figure represents the total cost of remedying existing critical deficiencies in the state highway system. It includes estimates for construction or reconstruction of 3,785 miles of the system.

The division estimated that only $22,000,000 a year, or $220,000,000 for the next ten years, could be allocated for construction under the present gasoline tax. An added cent of gasoline tax would increase revenues by approximately $20,000,000 it is estimated.

N.P.A. To Meet in April

NPN News Bureau

WASHINGTON—National Petroleum Assn. will hold its semi-annual meeting in Hotel Cleveland, Cleveland, O., next April 18 and 19, said Fayette B. Dow, general counsel, last week. Program details will be forthcoming soon.

Union Oil's Avgas Venture Reveals There Is An Eager Market for Higher Grade Gasoline

NPN News Bureau

LOS ANGELES—Union Oil Co.'s venture in the selling of 91-96 octane motor fuel was too short-lived to furnish accurate marketing data, but it did definitely prove a point in question. There is an eager and hitherto untouched market for a fourth and higher grade of gasoline.

This merchandising attempt in the field of super fuel for the automobile trade, unceremoniously interrupted by OPA, was closely watched not only by gasoline marketers, but by the automotive industry as well. To both it was revealing.

The results were surprising even to the Union Oil Co.'s marketing department. Union's merchandisers, of course, were well aware that the motoring public, long limited in quality as well as quantity of their gasoline, was far more octane conscious than before the war. They probably did not quite anticipate the quickness with which a market for aviation grade gasoline, selling at three and one half cents over the premium brand price, would be developed.

From this brief excursion in a new selling field, automobile manufacturers also found an answer to a $64 question of long standing. What is the public's interest in engines of higher compression?

Auto makers are already anticipating the day of higher compression engines and lighter fuels. The introduction of a super fuel, even before the design of the super engine, and its instant acceptance by a segment of the motoring public furnish Detroit with its answer.

The introduction of extra-premium motor fuel to the motorist was made without the usual fanfare that accompanies the marketing of a new brand name. It came without newspaper or billboard advertising, and with no other publicity than service stations bulletins and V-boards, a brief news item, and direct mail announcements to automobile manufacturers and to a number of registered owners of cars with high compression engines.

3½c Above Ethyl

On Sept. 11 the Union Oil Co. offered 91 octane aviation gasoline to motorists in the Los Angeles area. A few days later the product was introduced in other metropolitan centers along the Pacific Coast. This new brand gasoline, colored light blue, the color of aircraft light fuel, met federal aviation gasoline specifications AN-F-26 and was trademarked "7600 Aviation Grade 91/96." The price charged was 3½ cents above the price for Ethyl and 5½ cents more than the house brand, or 23½ cents a gallon in the Los Angeles area and 24 cents in the San Francisco Bay area.

Distribution soon attained fairly wide proportions, at least in the metropolitan areas. In Southern California distribution was not restricted to any area, but was extended to wherever facilities of supply made it available. Nor was the new gas restricted to super stations or key stations, but was offered for sale at most of the company's metropolitan outlets that had more than two pumps. (Union has no third grade gasoline).

The response by motorists was instantaneous. Although it is too early to get any statistical analysis of the results, some interesting facts regarding the selling appeal of this fuel have come to light.

Motorists bought the new product for a variety of reasons. Undoubtedly the owners of many cars, incapable of fully utilizing 91 octane grade, bought the gas for the sake of novelty. It was satisfying to the company, however, that this was not usually the case. Automobile owners showed a surprising knowledge of performance and octane ratings that was not general before the war. Owners of 1941 Buicks and Cadillacs filled their tanks because they expected better performance. Owners of shaved-head flivvers and other hopped models did the same. Other drivers realizing the compression limitations of their engines still felt they could, nonetheless utilize gasoline of a higher octane rating than the usual premium gasoline. These drivers tried a mixture of the new product on the basis of half Ethyl and half Avgas.

In talking to an NPN representative regarding the demand for "7600" a Union Oil Co. spokesman said, "they bought us out of house and home." One station sold 500 gallons per day as a total amount, of which 100 gallons was "7600." Another station whose daily average was 1,400 a day, averaged about 400 to 500 gallons of "7600" a day. These sales records were picked at random and were typical of the business done in the new extra premium gas. In the brief period that the super-fuel was on the market few if any service stations carried more than one shipment which was 1,000 to 2,000 gallons.

Motorists Satisfied

For the most part autoists who tried the new product were thoroughly satisfied. Owners of low compression cars who tried the Avgas for a thrill of course got little thrill. With the owners of high compression motors, however, the price factor was no deterrent. They were enthusiastic repeaters for the new "7600" brand.

Actually, the results of the test (in the light of the brief marketing period it must be regarded as a test), were satisfying to both the company and the customer. Since octane ratings for regular and premium brands on the West Coast are generally higher than in other parts of the country the locale was a fortunate one. There were, however, in addition to OPA, many factors working against the introduction of a super fuel at this time.

In general automobiles, long accustomed to heavy motor fuels, have been tuned down during their wartime visits to repair shops. Sparks have been retarded, carburetors adjusted, and manifolds have been set up where they were hot. In some cases extra head gaskets had been installed. All this, of course, worked against the utilization of a high grade gasoline.

Sales continued to grow in spite of the lack of advertising. The business in the super-fuel was being established on a firm footing when OPA stepped into the picture. Governmental interpretations halted sales in spite of the fact that the ex-tax price at service stations was not in excess of the identical product to the aviation trade.

For those who are not wholly familiar with the details of this case the following is a round by round description of the company's tangle with OPA.

On Sept. 11, the Union Oil Co. notified the local and Washington OPA offices of its action. This was in accordance with its policy to keep OPA advised of changes in marketing procedure. On Sept. 19, an OPA representative verbally advised the company that the term "aviation gasoline" in the opinion of that agency referred to gasoline sold for aircraft propulsion and that price exemption did not apply when aviation gasoline was sold for other purposes. This advice was confirmed in a night letter from the petroleum branch of OPA in Washington. The telegram stated that gasolines sold for use in automobiles were not aviation gasolines and there were only three recognized grades of automotive gasoline.

The company replied immediately to the OPA communication giving reasons why its action did not violate OPA regulations. Sales were not considered inflationary since there was an adequacy of the regular automotive gasoline available to the public on the Pacific Coast. However, on Oct. 1, a Los Angeles OPA representative advised the company of a pending OPA interpretation that gasoline sold for automobile use was not aviation gasoline and again the OPA recognized only three grades of automotive gasolines, namely third grade, regular and premium. Eleven days later the company was notified that amendments to existing OPA regulations would be issued and effective Oct. 15, in substance that amendments were to provide that gasoline sold for automobile use must be priced in line with one of the three recognized grades of automobile gasoline previously on the market.

Union Oil Co. in conformance with the preliminary advice, discontinued sale of its "7600 Aviation Grade 91/96" gasoline to the motoring public Oct. 14. The company could not economically continue to manufacture and sell 91 octane gasoline at the ceiling price of a lower grade.

OPA action in this case brought a flood of protest both from the motoring public and those concerned primarily with the question of governmental interference in business. Fulton Lewis, Jr., well-known Washington commentator, devoted most of one broadcast to the case. Mr. Lewis did not question OPA's right to set a ceiling price on any grade of gasoline, but he did question the pricing agency's

#5 in a series of advertisements discussing postwar refining processes.

"TOWER" PROPANE DEASPHALTING or Fractionation

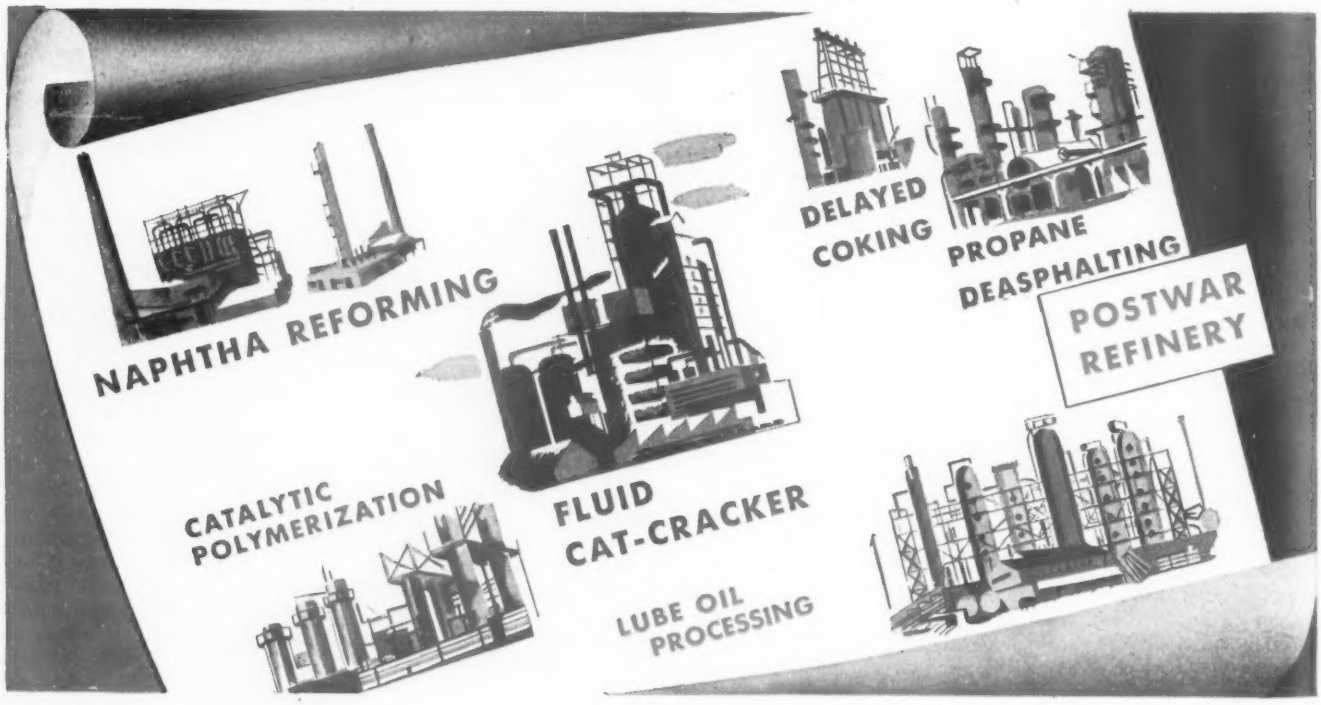
. . . LEADER IN A SERIES OF PROCESSES FOR PRODUCTION OF HIGH QUALITY LUBES WITH NEW EFFICIENCY!

UNDOUBTEDLY, this process represents one of the greatest improvements in lube oil manufacturing methods of recent years. To Kellogg process engineers who developed the system commercially, it represents an outstanding achievement in their work on lube processing.

High asphalt content is eliminated as a factor in the economical production of lubes of premium quality. Thus, crudes which have been previously considered unsuitable for the purpose have now been added to the nation's supply of raw materials. Utilizing similar equipment for fractionation, it avoids the cracking which usually occurs in distillation.

"Tower" Deasphalting, while an important unit, is just one of the complete series of propane processes for lubes offered by Kellogg. In conjunction with dewaxing, acid treating, and clay treatment . . . the lube refiner has at his disposal a complete operation in which propane is used with maximum efficiency for economical production. For deasphalted oils which require viscosity index improvement, the new Kellogg counter-current treating tower for phenol extraction has also proved unusually efficient.

Whether your postwar operation is focussed on production of premium lubes or conventional viscosity index products . . . you will be interested in the operating figures which Kellogg engineers can show you on processes which can be "custom tailored" to your crudes.



THE M. W. KELLOGG COMPANY

Engineers and Economists to the Petroleum Refining Industry

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right to say for what use the product should be utilized, since the same product was legally selling at the same price less tax for aviation use.

The attitude of the general public and others in the controversy is illustrated by the following letters to Reese Taylor, Union Oil president, and Rep. Franck R. Havenner, respectively:

"I was shocked to learn that the OPA had made it impossible for you to continue marketing this gasoline.

"This to my mind is an outrageous abuse of official power. The action of the OPA in this particular has no relation to maintaining price levels or combating inflation. Superior grades of gasoline (better than motorists have ever known) are available at OPA prices. If motorists desire to obtain extra grades of gasoline, which can only be marketed at higher prices, it is their right and privilege to do so.

"This is an outstanding example of the manner in which the exercise of bureaucratic power results in stifling the progress and prosperity that have made America great. I suppose that if the OPA had been in power when automobiles were first introduced, they would have prohibited the marketing of automobiles unless they sold for the same price as a horse and buggy. Likewise, if the OPA had been in power when electric refrigerators had been produced, they would have prohibited the marketing of electric refrigerators unless sold for the same price as the old-fashioned ice box. It would be just as logical for OPA to prescribe that all men's suits should be sold at a price not to exceed $40, or to prescribe that all automobiles should be sold at the price of a Ford automobile.

"American citizens have the right to acquire and utilize the highest quality of any article or material, and to pay for it such price as will make it possible to have it marketed. This is essential to any progress and development in this nation.

"It is about time that we had some peace criminal trials in this nation, to prosecute the officials who have ruthlessly exercised their official powers to vio'ate the rights of the American people. Public officials must be taught that the rights of citizens are sacred, and that to trifle with them or to use official power to violate them, means certain and dire punishment.

"I hope that the Union Oil Co. will pursue such remedies as may be available to expose this outrage, and to invoke the public condemnation which it justly deserves.

Byron C. Hanna"
(Los Angeles Attorney)

"Dear Mr. Congressman:—

"A few days back the Union Oil Co. sent out an announcement that its aviation gasoline was to be made available to motorists, and that it would be of particular interest to owners of high compression motors. It was priced at 3½c above the price of ethyl gas.

"Although I have been a customer (and shareholder) of Standard Oil of California for years, I was much interested in trying out the aviation grade,—but before I had opportunity to do so an "all wise" Washington bureau decreed that I could not have that privilege. Viz: the OPA decreed that while the price was all right if sold for aviation use, the gas could not be sold to motorists unless at the lower price fixed for Ethyl grade. And at the lower price Union Oil would not sell the aviation grade at present.

"I resent being heavily taxed to support bureaucrats in Washington to exercise war powers in peace time, to tell me what I may or may not buy. Or to decide for me, whether I should be permitted to buy a better grade of gas at a higher price, or even whether I should be permitted to pay a higher price for something not really worth the money.

"I resent being taxed to support bureaucrats to impede the progress of reconversion. Except for non procurable materials, higher prices in a free economy is the quickest way to force plentiful production that will in turn force prices to an equitable level.

"I am willing to be taxed to pay you, (and all senators and congressmen) a higher salary to represent me in Washington. And to see to it that war powers are cancelled and freedom restored to the economy. Even freedom to waste my own money if I want to do so. I hope lots of others feel the same way. I am sure they do.

"On the matter of increased compensation to elected representatives I think that the rate should be raised. Unquestionably. A senator or congressman should be paid on a basis that will not compare too unfavorably with the compensation of labor union officials or with reasonably successful businessmen. I trust that you will support the movement to increase this rate of pay.

Sincerely
W. H. French"

U. of Okla. Foundation Plans History of Oil in Southwest

NPN News Bureau

TULSA, Okla.—Acceptance of a grant of $15,000 by the University of Oklahoma Foundation to compile a history of oil in the Southwest was announced Nov. 2 by Standard Oil Co. (N. J.)

Writing, publication and distribution will be entirely in the hands of the foundation, an agency of the university created to receive grants for such projects.

Iowa Jobbers Term State Retail Tax Method 'Discriminatory'

Special to NPN

MANCHESTER, Iowa--A. C. Gienapp, secretary of the Iowa Independent Oil Jobbers' Assn., last week in a statement to the Iowa Tax Commission at Des Moines, asserted that the present method of handling the state's retail sales tax is discriminatory in favor of the major oil companies at the expense of independent distributors.

He told the commission that the association was not objecting to the tax but "we are of the opinion the tax ought to be administered with equal fairness to all parties concerned, either by imposing the same policy on the majors or by eliminating the tax on tax for the independent distributors", Mr. Gienapp said.

Mr. Gienapp told the commission:

"All major oil companies and independent oil jobbers have a retail tax permit. In selling lubricating oil in bulk lots to the consumer (bulk means 5 gal., 10 gal., 15 gal., 30 gal., barrels, 10 bbls., 25 bbls., depending on how big a consumer may be) the independent distributor is asked to collect the retail sales tax, not only on the price of the oil, but including the federal excise tax of 6 cents per gallon. On the other hand a major oil company making the same sale to the same consumer collects the retail sales tax on the price of only the oil. We are of the opinion this is discriminatory in favor of the major oil companies at the expense of the independent distributor."

Mr. Gienapp explained that bus lines, truck lines, railroads, packing plants and many other manufacturing plants are large consumers of lubricating oils within the state. "It is the large consumer who objects to the payment of the tax, knowing he can purchase the same oil from major oil company without it, everything being equal", he said.

In many instances, he said, a large consumer would rather give his business to an independent distributor, as their business relations are more close than they are with a big company. But, he said, when it comes to the tax, they draw the line.

Midwest Tank-Wagon Prices on Fuel Oils Go Up Nov. 5

CHICAGO — Up go tank wagon selling prices on fuel oil 3/10 of a cent, effective Nov. 5, say a majority of midwestern refiners, and others are contemplating increases.

Previously-rationed fuel oils, including kerosine Nos. 1, 2, 3, 4, and 5, range oil and Diesel fuel are affected to offset last August's reduction when rationing was lifted.

OPA originally approved the increase to compensate for extra rationing work, then it was dropped when rationing ended. OPA, however, has allowed the increase again while it completes its study.

HEARIN TANK LINES
Petroleum Transporters
MASON AVENUE
BATON ROUGE, LOUISIANA

August 17, 1945

[Name of Company furnished on request]

Gentlemen:

We have your letter of August 14th in which you request information as to our experience with the Heil tandem petroleum transport trailers.

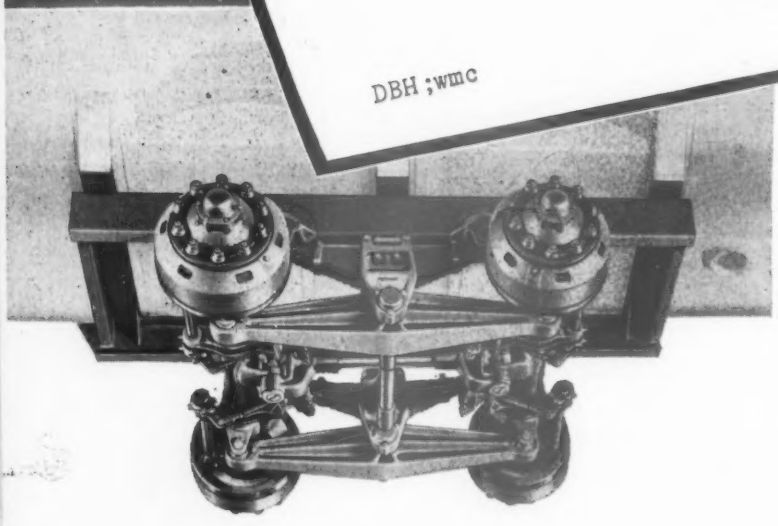
In our opinion, the tandem is the most satisfactory on the market. We have several 5000 gallon units which have been in operation since 1942, and have had no trouble at all with them. When purchased, these units were placed in operation in Arkansas where road conditions are most unfavorable to this type unit, and they performed beyond our expectations. We are able to obtain from 150,000 to 200,000 miles before overhauling and rebushing. I do not recall having had any tank leakage whatsoever. We have tried several types of tandems, including some of the most widely advertised units, and found the Heil to be the only satisfactory one we have used.

We trust that this is the information you desire, and if there is anything further, do not hesitate to call on us.

Very truly yours,

Don B. Hearin, Jr.

DBH;wmc



Here is a partial assembly view of the Heil Tandem axle that shows the soundness of design and construction . . . plus many features that aid in giving you stabilized loads.

T-174

Heil Tandem Axle Running Gear Combines Maximum Flexibility with Rugged Performance . . .

1. Ball and socket joints reduce friction . . . provide maximum flexing action.
2. Rigid equalizer beams eliminate misalignment of axles caused by uneven deflection of springs.
3. Springs are restricted to load-carrying function only.
4. Rubber bushed torque tube requires no lubrication.
5. Thrust bar keeps both springs parallel —eliminating tortional side deflection.
6. Four-point mounting of entire tandem suspension distributes load equally.

There are many more features you should know about. Send for the complete details.

"...en where road conditions were most unfavorable, He "Trailerized"* Petroleum Transports p*rformed beyond our expectations"*

*frameless

Here is another example that demonstrates the ability of Heil "Trailerized" Petroleum Transports to travel for many thousands of miles without those small troublesome repairs that add up to major losses in hauling profits. This experienced operator says there has been no tank leakage . . . and after trying several types of tandems, Heil proved to be the *most* satisfactory one used.

The experience of this well-known opera tor is typical of many. They all agree that Heil Transport Tanks give you greater payloads without increasing gross weight . . . lower cost per gallon which results from increased payload per trip and more trips per month . . . safe operation and easy pulling because of correct engineering design — plus dozens of other features that pay off in safe, dependable, profitable operation.

Write for further detailed information or see your nearby Heil distributor.

ARMY NAVY

TEAR OUT THIS COUPON AND MAIL TODAY

THE HEIL CO.

GENERAL OFFICES • MILWAUKEE 1, WISCONSIN

THE HEIL CO., Milwaukee 1, Wisconsin

Please send me bulletin and other information about Heil "Trailerized" Petroleum Tanks.

Name.....

Position.....

Company.....

Address.....

City.....(.....) State.....

Stabilization Administrator Issues 'Rulings And Explanations' of New Wage-Price Policy

NPN News Bureau

WASHINGTON — Following President Truman's announcement of the government's new wage-price policy, Stabilization Administrator John C. Collet issued official "rulings and explanations". Published here are pertinent portions of these rulings and explanations in the form of questions and answers.

1. Do employers now have to get government approval before increasing wages?

No. Employers are free to increase wages without government approval.

There are (however) two exceptions to the general rule . . . in the building and construction industry, wartime wage controls have been extended until Nov. 18, 1945. Wage controls established by the Department of Agriculture with respect to agricultural labor continue in effect.

2. May unapproved wage increases be used as a basis for an increase in price ceilings?

No. The executive order provides that a wage increase may not be used in whole or in part as a basis for seeking an increase in ceilings, or for increasing costs to the United States, unless it has been approved by the government's wage stabilization agencies.

3. The government's wage stabilization agencies will approve for pricing purposes wage increases falling into certain defined classes. Does this mean that all other wage increases are disapproved by the government?

By no means. The wage stabilization agencies concern themselves only with wage increases which management desires to use as a basis for price increases, or for resisting price decreases or increasing costs to the United States. "Approval" of a wage increase, therefore, simply means that it may be used for one of these purposes and withholding of approval that it may not. Except in this sense (and with the exceptions noted in the answer to question 1), the government no longer formally approves or disapproves any wage increases.

4. Does the fact that a particular wage increase falls into a class that will be approved by the government's wage stabilization agencies mean that wage increases of this type will be directed by the government?

No. Just as the government no longer prohibits wage increases in excess of certain standards so it no longer directs them. Wage increases are to be granted by employers or agreed to as the result of collective bargaining, conciliation or arbitration. The standards for approvable wage increases merely determine when increases arrived at in these ways may be used for pricing purposes.

Waives Right to Use Wage Boost As Basis for Price Increase

5. When an employer agrees to a wage increase and puts it into effect without securing approval of its use for pricing purposes, may he seek such approval afterwards?

Yes. By putting a wage increase into effect, an employer waives the right to use it as a basis for an increase in price ceilings (or for the other purposes stated in the executive order) unless and until it has been approved by the wage stabilization agencies. But he does not waive the right to seek such approval. Approval will be given or withheld on the same basis as if the employer had made his application before putting the wage increase into effect.

6. Does an employer's failure to seek or obtain approval of a wage increase mean that he waives indefinitely any right to have it considered for pricing purposes?

No. The purpose of the executive order is to encourage voluntary settlements of wage questions. An employer's reasonable expectation that he will be able to absorb a wage increase may be disappointed by unfavorable developments. If this happens he will not be penalized because he was willing to take chances in an effort to settle his wage controversies.

If, after a reasonable test period—six months after the wage increase was made, save in exceptional circumstances—it is shown that an industry will be unable to absorb the increase, the Office of Price Administration will take the increase into account in applying its standards governing price increase.

A test period longer than six months will not be required unless the industry's experience within that period is clearly unrepresentative or unreliable. A similar rule will be followed in those cases in which ceiling prices are fixed or adjusted on an individual-firm basis.

7. Is an employer who has in effect an unapproved wage increase barred from receiving any ceiling price relief at all until the expiration of a reasonable test period after allowance of the wage increase?

No. If the employer sustains other cost increases, such as an increase in materials prices, these may, of course, be taken into account for pricing purposes. In determining what, if any increase in price ceilings is required because of such factors, before the expiration of a reasonable test period, the increase in costs attributable to the wage increase will be disregarded. In such a case, the amount of the increase in costs attributable to the wage increase will be taken to be equal to the amount of the increase in payroll resulting from the wage increase, unless it is shown to be less than that.

Wage Stabilization Agency Approval of Pay Raise

8. When the wage stabilization agencies approve a wage increase, in whole or in part, does that mean the employer will then be permitted to increase his prices by the same amount that he has increased his wages?

No. OPA, in passing on an application for a price increase, will take the approved wage increase into account as an element of costs. The wage stabilization agencies, however, will not have passed on the question whether, taking the wage increase into account, a price increase is required, that question will be decided by OPA, applying the appropriate pricing standards. In deciding this question, OPA will ordinarily act on the basis of estimates as to the effect of the wage increase.

9. What are the classes of wage increases which the wage stabilization agencies will approve for pricing purposes?

First: Increases where the percentage increase in average straight-time hourly earnings in the appropriate unit since Jan. 1941 has not equalled the percentage increase in the cost of living between Jan. 1941 and Sept. 1945.

Second: Increases necessary to correct inequities in wage rates among plants in the same industry or locality, with due regard to normal competitive relationships.

Third: Increases necessary to insure full production in an industry designated by the stabilization administrator, which is essential to reconversion and in which existing wage rates are inadequate to the recruitment of needed manpower.

In addition, approval will continue to be given wage increases which satisfy the wage standards in effect before Aug. 18, 1945.

10. Is the present list of classes of approvable wage increases a final and inflexible one?

No. Other classes will be added by the Stabilization Administrator if experience shows the need for them. In determining whether additional classes of wage increases should be approved, however, the Stabilization Administrator will continue to be guided by the overriding necessity of maintaining the stability of the economy.

11. What will be the practical effect of the first of the above standards?

The cost of living in the nation as a whole has increased approximately 30% since January 1941. If the average straight time hourly earnings of employees in the appropriate unit have increased by less than 30% since Jan. 1941, this standard will permit the removal of price obstacles to a wage increase sufficient to make up the difference.

Straight-time hourly earnings in the majority of industries are currently more than 30% above their Jan. 1941 levels. This standard, therefore, is needed to facilitate wage increases only in the minority of plants and industries in which wages have lagged behind the cost of living.

12. What will be the practical effect of the second of the above standards?

Wartime dislocations and changes in conditions growing out of the war have resulted in various distortions in wage relationships as between different plants. This standard will assure that price ceilings do not stand in the way of the restoration or establishment of appropriate wage relationships in these inter-plant situations. It will permit greater flexibility in the correction of distorted wage relationships than was possible under the rigid requirements of wartime wage standards as applied in the so-called "bracket system." Since wage increases under this standard will be made on a plant rather than an industry basis, the standard is unlikely to have a material effect on commodity price levels.

Practical Effect of Standard

13. What will be the practical effect of the third of the above standards?

Continuous studies are being made of the problems of reconversion industries, in consultation with industry, labor and other government agencies. Whenever it is determined that existing wages in a particular industry are inadequate to recruit needed manpower and this inadequacy is causing a bottleneck which is retarding reconversion, the Stabilization Administrator will so announce. It is expected that few industries will be found to fall in this category.

14. When a wage increase might be approved under two or more standards, will the amount approvable under each standard be added together and approval given to a wage increase equal to their sum?

No. The correction of an inequity requiring a larger wage increase will result in the correction also of any other inequity requiring lesser increase.

15. Suppose that a wage rate increase of six cents an hour would be approvable, if it stood alone, and an employer grants a total increase of 16 cents an hour. May he still secure approval of an increase of six cents?

Yes. The 10c increase, in other words, will not be treated as removing the basis for approval of the six cent increase.

16. Will the National War Labor Board or other designated wage agency approve a wage increase whenever it finds that it falls within one of the standards for approvable wage increases above described?

Not invariably. A particular wage increase must first be found by the Board or other agency to be necessary to correct a maladjustment or inequity which would interfere with the effective transition to a peacetime economy. Usually this finding can and will be made. In such case the further approval of the stabilization will have been given in advance. Cases may arise, however, in which, on the particular facts presented, a finding by the Board or other agency that a maladjustment or inequity exists would be inappropriate and will not be made.

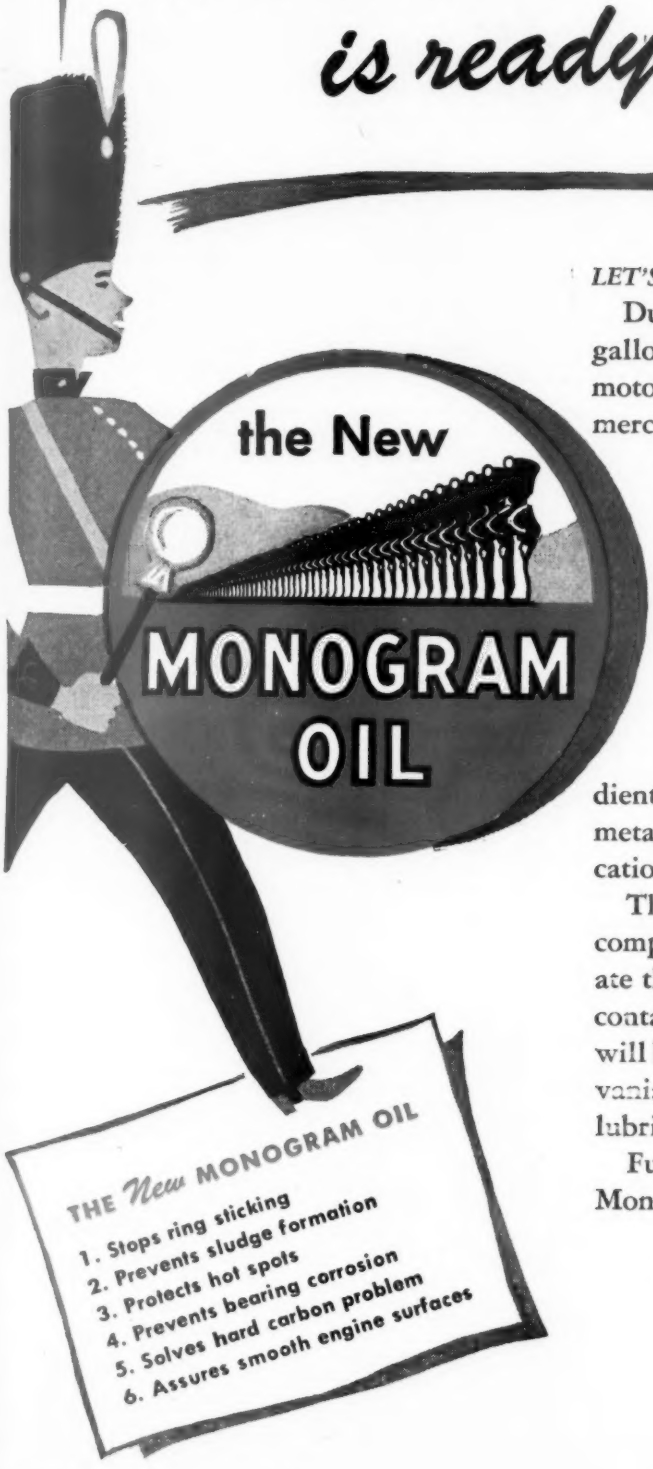
17. What procedure should be followed by an employer who wishes to obtain approval of a wage increase which he has put into effect or agreed to put into effect?

He should follow the procedures now in existence for obtaining the approval from the appropriate wage stabilization agency. For example, application for approval of a wage increase in a case now falling within the jurisdiction of the War Labor Board should be filed with the nearest local office of the Wage and Hour Division of the Department of Labor on a form supplied by that office (form 10, pending preparation of a new form). That office will transmit the application to the appropriate office of the War Labor Board.

The War Labor Board or other appropriate wage stabilization agency will be authorized to give final approval to applications, in whole or in part, if it finds that the wage increase involved is within one of the standards described above or any other standard to which advance approval has been given by the stabilization administrator.

The Wage Stabilization Agency will not follow the former practice of referring applications to the Office of Price Administration for an advance opinion as to whether a price increase will in fact be required. The price question will be considered only if the wage increase is approved.

the new MONOGRAM OIL *is ready now!*



LET'S LOOK AT THE facts about the *new* Monogram Oil.

During the war years, we manufactured millions of gallons of high grade lubricating oils for Army and Navy motorized equipment and for essential, heavy duty commercial vehicles. This was *special* oil . . . designed and *engineered* to make engines last longer and require fewer service operations and repairs.

This *special* oil contains an additive compound composed of several different types of ingredients. Each ingredient performs a distinct function . . . one is a powerful, yet safe detergent; another is an inhibitor against formation of sludge, gum, carbon and corrosive acids that naturally form in all internal combustion engines; and still another ingredient is a specific oil that has a natural attraction for metal. Combined, they form *the additive* that made lubrication history during the war years.

The intimate knowledge of just how well this specific compound performed brought about the decision to create the *new* Monogram Oil . . . and now *all* Monogram contains this same type additive. The motoring public will be quick to recognize the advantages of fine Pennsylvania oil plus the additional benefits built into this *better* lubrication.

Further information about the *new* Monogram and the Monogram franchise will be sent on request.

NEW YORK LUBRICATING OIL CO.
116 Broad Street, New York 4, N. Y.

Goodyear Designs Plan to Increase Efficiency of Dealers

'Merchandising Laboratories' To Act as a Clinic for Retail Outlets

Special to NPN

AKRON, O.—If the live retail outlets for petroleum products and tires and batteries do not become as efficient as the best run chain stores in the near future, it will not be the fault of the large manufacturers who distribute through them.

Goodyear Tire & Rubber Co. unveiled on Oct. 27 its elaborate plan for educating its dealers to be better merchants. It joined the ever growing group of suppliers of whom the oil companies particularly have been in the forefront and who have been working to make better dealers for a good many years. It may be fairly said that the Goodyear plan is just about the most extensive and thorough of any presented to date. It not only goes into detailed store improvement for very small stores to good sized ones, but it helps the dealer to display and sell merchandise even that which Goodyear does not make or supply. It also teaches the dealer better accounting and especially store bookkeeping so he will know just what each item he offers is doing in turnover and profit.

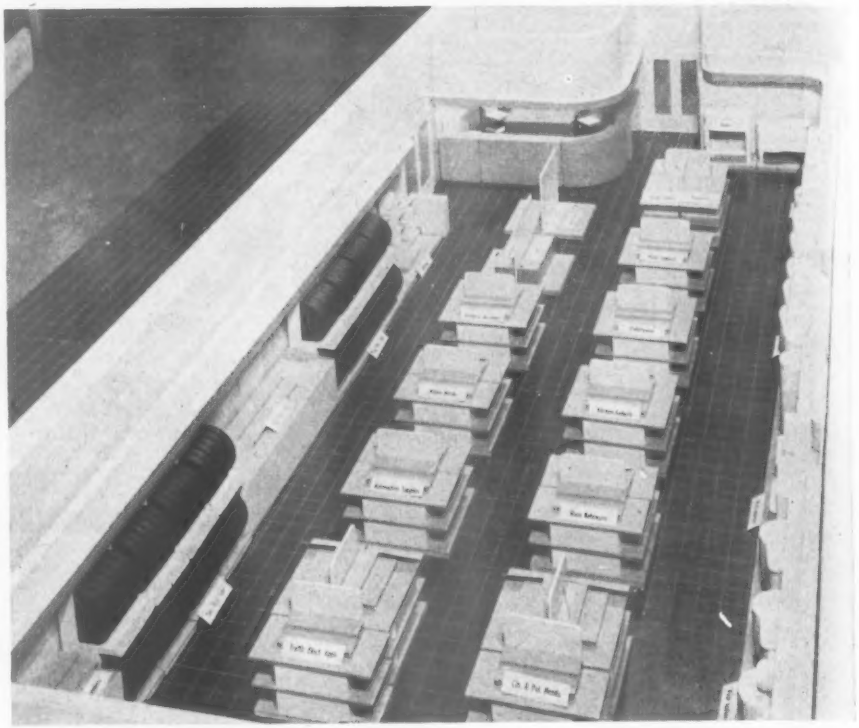
Goodyear has established a large and specially manned department devoted exclusively to this work. It is the result of some years study. It is housed in large quarters of the general office building, with extensive sample store rooms illustrating all the Goodyear recommendations. Plans will be developed for dealers, with special drawings as well as standard manuals to be sent dealers by mail on their request but provision is also made for the dealer to visit the display in Akron for personal discussion of his needs.

School of Supervisors

To make certain that the dealer adopting the Goodyear material makes the most of it and that his interest in it does not die down, a large school of supervisors is being conducted of full time Goodyear employes, and many of their dealer salesmen and district managers are also going through the school. Through these it is intended to keep the dealer directly prodded to the best use of the material from Akron.

To the oil industry this means that Goodyear dealers who sell petroleum products also, or to put it the other way—for Goodyear notes a distinction—oil companies who sell Goodyear products and who distribute them to their dealers, will be the beneficiaries of this merchandising improvement in the dealers, though in the case of the oil companies, they will have to decide finally whose merchandise plan signs and materials will dominate the outlets, Goodyear or other merchandise supplier or the supplying oil company.

As Goodyear is limiting this plan to its regular dealers and to new dealers who do not conflict with present outlets and will not give any more unrestricted territorial distributorships, the introduction of this elaborate merchandising training plan means to a large part of the oil industry that it will have much keener and intelligent competition as the plan goes into effect over the country. At present some 500 of their dealers have adopted it and old dealers are being equipped with it at the rate of some 40 a month but as the new sales supervisors staff emerges from the training school this number will be stepped up rapidly.



Fixture models, built to scale, are used to visualize how the dealer's merchandise will be departmentalized and displayed. Scale models of service equipment also are used to show most efficient arrangement of auto and tire service departments

This new merchandising plan is developed and promoted by what Goodyear calls its "Visual Merchandising Laboratory" which is constituted of the new offices and display rooms here at Akron. The plan was given its introduction to the public through a special press preview here to which several score business and merchandising writers of newspapers, writing syndicates and trade papers were invited. Chairman Litchfield, President Thomas, Vice President of Sales Wilson and Vice president of Tire Sales Mayl, and other officers and department heads officiated at the introduction.

In their talks, they emphasized the need for far more efficient and economical distribution of merchandise else there will be encroachments on private enterprise of various radical theories. Only by making the independent merchant, the small man especially, highly efficient, these officers said, can private enterprise be safeguarded and further developed. Their opinion was that the small merchant, if he takes the fullest possible advantage of the training that large suppliers such as Goodyear and the oil companies are trying to give him, can be on as efficient and economical overall basis as are the branches of the best run chain stores and outlets. Perhaps some costs may not be quite as low but any disadvantage in that direction, it was their opinion, will be more than offset by the other advantages such as the personal standing and personal interest of the individual merchant among his neighbors. By bringing together the best experience of all merchants, big and little, carefully sifted and thought out, they believe that the so-called small merchant will continue to grow at reasonable profits to himself.

The Visual Merchandising Laboratories will show the dealer what lines of merchandise to carry, how to display and promote them, how to allocate his floor and wall space, and how to make his store most attractive. Studies have been made over the past 15 months on product and package design, store fixture and service equipment design, store layout, store design, scientific departmentalization of merchandise and allocation of store space, promotional window displays, and methods of pricing.

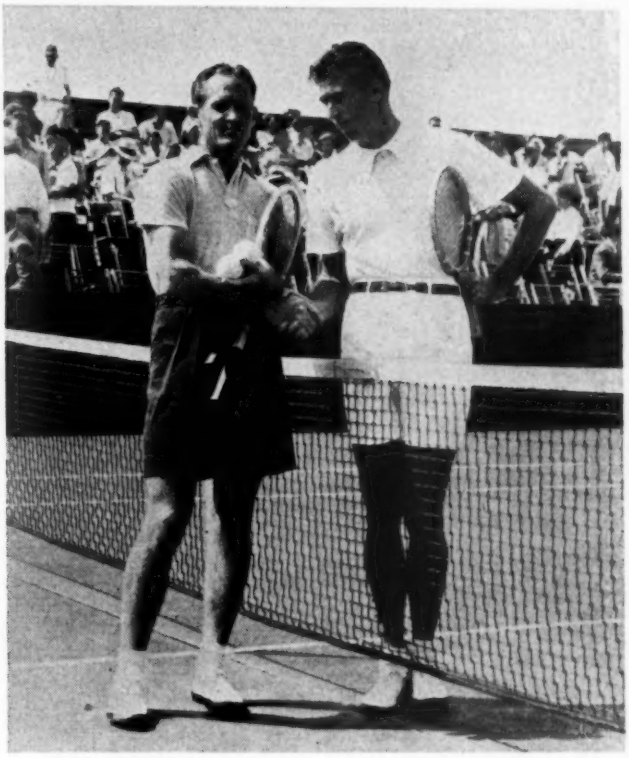
To make better merchants of its 12,000 direct contract dealers and a total of 30,000 retail operators, Goodyear has

Tri-Sure News

NUMBER 35 ★ 30 ROCKEFELLER PLAZA, NEW YORK 20, NEW YORK ★ NOVEMBER, 1945

OILMEN ATTEND EXHIBITION MATCHES BY SKEEN AND VAN HORN

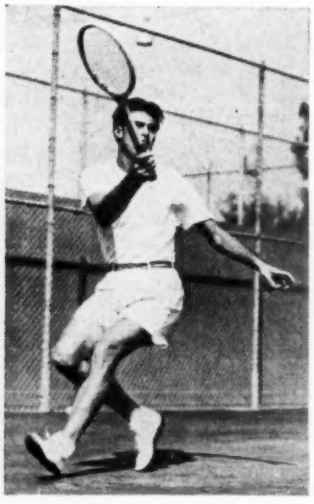
Tennis "Clinic" Is Featured In National Tour Sponsored By American Flange & Mfg. Co. Inc.



Mr. Skeen and Mr. Van Horn, after their ezhibition match at Beverly Hills, California

Dick Skeen and Welby Van Horn, internationally famous tennis players, have completed a nation-wide tour of leading cities and oil centers, where they have played exhibition matches and conducted a series of tennis "clinics". The tour was sponsored by the American Flange & Manufacturing Co. Inc. to encourage active participation in sports among men and women in the petroleum industry, and to stimulate interest in tennis as a game for health and recreation. The "clinics" have proved extremely popular among the many tennis fans of the industry, who have picked up valuable pointers from the talks and demonstrations which Mr. Skeen and Mr. Van Horn have given on the principles of sound foot work, tennis grips, training, etc.

Dick Skeen



Welby Van Horn

Both Mr. Skeen and Mr. Van Horn have won high honors in the tennis world. Mr. Skeen, the country's most noted tennis teacher, who has tutored such stars as Jack Kramer, Pauline Betz, Louise Brough and many others, has also won top-flight ranking as a professional tennis player, both in National and World Tennis Tournaments. Mr. Van Horn won the North-South Professional Championships both in 1944 and 1945, and in 1945 won the National Professional Championship of the United States.

AMERICAN FLANGE & MANUFACTURING CO. INC., 30 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

TRI-SURE PRODUCTS LIMITED, ST. CATHARINES, ONTARIO, CANADA

The Largest of Three Full-Sized Stores in 'Visual Merchandising Laboratories'

View of the largest of the three full-sized stores in the "Visual Merchandising Laboratories." Ceiling-to-floor windows bring passers-by closer to the merchandise and make the store more inviting. Fixtures for window displays focus attention from the sidewalk but are integrated into the inside floor display

simplified its merchandising program and offers suggestions on remodeling old stores or building new stores that will incorporate standardized store layouts, display equipment, merchandise lines and inventories, monthly and seasonal promotions. All types and sizes of outlets for tires are served from the Visual Merchandising Laboratories—tire dealers, car dealers, airport stations, gasoline filling stations. Although Goodyear has sales agreements with two major oil companies it does not intend to use this program to extend its branded distribution by unrestricted contracts through oil companies or independent oil jobbers.

The laboratories act as a clinic for the retail dealer. The dealer tells what services he performs, what items of merchandise he sells or wishes to sell, the size of his lot or building. With this information and after discussion with the dealer, the merchandising laboratories prepare a recommendation for outside design of the store, a layout of the store and service floor space, suggested display fixtures and service equipment, and a tailor-made inventory of merchandise lines. When the dealer accepts the "prescription," he arranges for the necessary construction work locally and the installation of fixtures and merchandise displays is supervised by a Goodyear representative.

Display Fixtures

Three lines of fixtures are available from the company; all developed in the merchandising laboratories. Each line is composed of basic units which can be fitted together in many different combinations to serve the specific needs of different kinds and sizes of retail outlets. They are designed to make maximum display use of available floor and wall space and to house the kinds of merchandise the dealer sells.

The kinds of merchandise recommended by Goodyear are those that a man is not afraid to buy. In order of saleability through a retail tire store they are:

1—Automotive accessories
2—Hardware.
3—Bicycles and wheel goods.
4—Sporting goods.
5—Traffic goods and packaged electrical appliances like toasters, mixers, etc.

While the company has sales arrangements with General Electric distributors on major electrical appliances and with a radio manufacturer, it will not recommend that all retail outlets merchandise these items which require service departments and outside service cal's. Whether the retailer adds these lines depends on his individual ability to extend his efforts to do an adequate merchandising job. Where he takes them on, the appliance distributor bills Goodyear, who carry the account, and re-bill the dealer.

216 Items of Merchandise

One special package, developed for gasoline filling stations, includes 216 items of merchandise, mostly automotive, with an inventory cost of $516.00. Model inventories are departmentalized and recommended in one of three sizes: small, medium and large. Re-orders on merchandise can be filled from 46 warehouses located throughout the United States. The gasoline filling station fixtures and layout are designed to make over what was normally only an office space into a display room. To date some 4,000 display fixtures have been installed at 700 gasoline stations.

The merchandising laboratories are continuing their experiments with new ideas. At present a new fixture has been designed for placement just inside the door of the store to display a weekly promotion. Experiments with floor-to-ceiling windows of glass have shown that they need fixtures to provide window display. The fixture developed also serves as floor display inside the store.

While the Visual Merchandising Lab-

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100% Pure PENNSYLVANIA Motor Oils

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POST
THE SATURDAY EVENING POST
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WHAT YOU GAIN BY USING THESE "BALANCED" OILS
These oils pump and flow freely.
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They are oils that can take severe punishment.
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Emblem quality 100% Pure Pennsylvania Motor Oil means more to your business than just the gallonage and dollars it represents. Because of the wide public preference for this oil—because of its even wider recognition as peak quality—it gives your business high rating on the vital points of *good* products and *good* service.

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MEMBER OF PENNSYLVANIA GRADE CRUDE OIL ASSOCIATION
Guaranteed
100% PURE
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Made from the highest grade crude oil in the world

For your protection, only oils made from 100% Pure Pennsylvania Grade Crude which meet our rigid quality requirements are entitled to carry this emblem, the registered badge of source, quality and membership in our Association.

PENNSYLVANIA GRADE CRUDE OIL ASSOCIATION

OIL CITY, PENNSYLVANIA

oratories have worked to make it easiest for the consumer to buy—through proper allocation of space, prominent display, attractive packaging, timely promotion—Goodyear emphasizes that the successful retail dealer has to maintain his own records to determine which lines and items are most profitable for him in his location and, as a tire dealer, he must still work to make his place of business a tire service center.

Other assistance provided dealers include help in selecting sites, hiring and training people, product sales and service, and record keeping. Two bookkeeping or accounting systems are available. With new dealers, the district credit manager will install the bookkeeping system for the dealer and then check back in 60 days to see if the system is working satisfactorily.

Liquefied Gas Use Tripled In Last 2 Years—Davies

NPN News Bureau

WASHINGTON—Deputy PAW Ralph K. Davies said last week production and use of liquefied petroleum gases, including separate fractions and mixtures of propane and butanes tripled in the last two years.

His information, based on a nationwide survey by liquefied petroleum gas industry representatives and directed by PAW excluded only California, Arizona, Nevada, Oregon and Washington where a separate survey was made.

The report showed estimated production of liquefied petroleum gas (LPG) for 1945 set at 115,064,829 bbls. (4,832,722,818 gals.), an increase of 27% over 1944 production and more than triple that of 1943.

War production importance of the gases, particularly for high octane gasolines, synthetic rubber and chemicals was indicated. In 1944, 9,683,345 bbls. went into synthetic rubber and chemicals and anticipated use for 1945 was placed at 12,883,127 bbls., 33% over 1944 and 225% over 1943's 3,950,000 bbls.

Estimated LPG use for 1945 refinery operations totaled 82,587,841 bbls. or 26% over 1944 and nearly 125% over 1943's 37,100,214 bbls.

Despite restrictions for war purposes, fuel use of LPG went from 15,485,041 bbls. in 1944 to 18,089,146 in 1945, an increase of 17%.

Mr. Davies explained the data on the basis of actual operations for the first three months of 1945 and estimates for the last nine months were based on requirements of a two-front war. During the conflict, he added, it was "nip-and-tuck" to supply the increasing demand.

Calif. Production Reported

NPN News Bureau

LOS ANGELES—The American Petroleum Institute estimates the daily average crude oil production in California for the week ended Oct. 27, 1945, was 843,400 bbls.

Shell Oil to Build Research, Exploration Center in Texas

NPN News Bureau

NEW YORK—Shell Oil Co., Inc., last week said ground will be broken in Houston in the near future for the construction of a new oil exploration and research center devoted to studying new methods of finding oil and getting it out of the ground.

The new research center, costing almost one million dollars, is expected to be completed by spring and will house the company's recently organized division of exploration and production research. Plans call for a two-story, air-conditioned building covering 40,000 square feet to accommodate a working staff which eventually will be expanded to 155.

Seek to Learn Corrosion Cause In Recovery Oil Operations

Special to NPN

OIL CITY, Pa.—Samples of bottom hole water from a dozen wells in the Oil City-Pleasantville area will be analyzed at Battelle Memorial Institute, Columbus, O., in an effort to learn the cause and cure of corrosion in air-gas secondary recovery oil producing operations in the Pennsylvania Grade region.

C. E. Stout, Parkersburg, W. Va., production research engineer for the Pennsylvania Grade Crude Oil Assn., has just completed collection of the samples. The work was done in conjunction with R. B. Bossler of the Brundred Oil Corp., Oil City, a member of the association's research advisory committee.

Texas Alters Its Producing Schedule for November

Special to NPN

AUSTIN, Tex.—The Texas Railroad Commission has raised Texas producing days for Nov. from 21 to 24 with exception of Panhandle and East Texas, to meet increasing demand for crude.

The alternation in the schedule will result in average daily allowable of 2,016,198 b/d, an increase of 207,449 bbls. over average allowable reported on Oct. 27, and an increase of 171,617 bbls. over originally announced allowable for November.

Ickes Declares U. S. Has Only a 35-Year Supply of Petroleum

NPN News Bureau

NEW YORK — The war's drain on America's minerals and its enforced rationing of fuel and gasoline makes it imperative that the United States build a stockpile of these sinews of military and industrial power as well as finance the exploration of marginal and submarginal resources, declares Secretary of Interior Ickes in a signed article of The American Magazine, December issue.

The war so bankrupted some of our most vital mineral resources, writes Mr. Ickes, that "we no longer deserve to be listed with Russia and the British Empire as one of the 'Have' nations of the world. We should be listed with the 'Have Nots,' such as Germany and Japan."

The secretary points out that the U. S. possesses "less than a 35-year peacetime commercial supply of 21 minerals, namely petroleum, copper, lead, zinc, sulphur, natural gas, fluor spar, cadmium, gold, silver, bauxite, vanadium, antimony, tungsten, platinum, asbestos, manganese, chromite, nickel and tin.

Mr. Ickes says "one of the surest ways of assuring our basic security in minerals in time of need" is to build up stockpiles. "Our second line of defense is our marginal and submarginal resources. Exploration for new deposits should be carried on vigorously and plans made for emergency production. Since the defense of the nation is involved, the work of private industry should be aided by government research and by government-sponsored explorations. We must encourage and support, morally and financially, the investigations of our research workers and scientists."

Bureau of Mines Forecasts Nov. Crude Demand at 4,600,000 B/D

WASHINGTON—Domestic and foreign crude stocks totaled 226,397,000 bbls. at close of week ended Oct. 20, down 1,157,000 bbls. from previous week, Bureau of Mines announced.

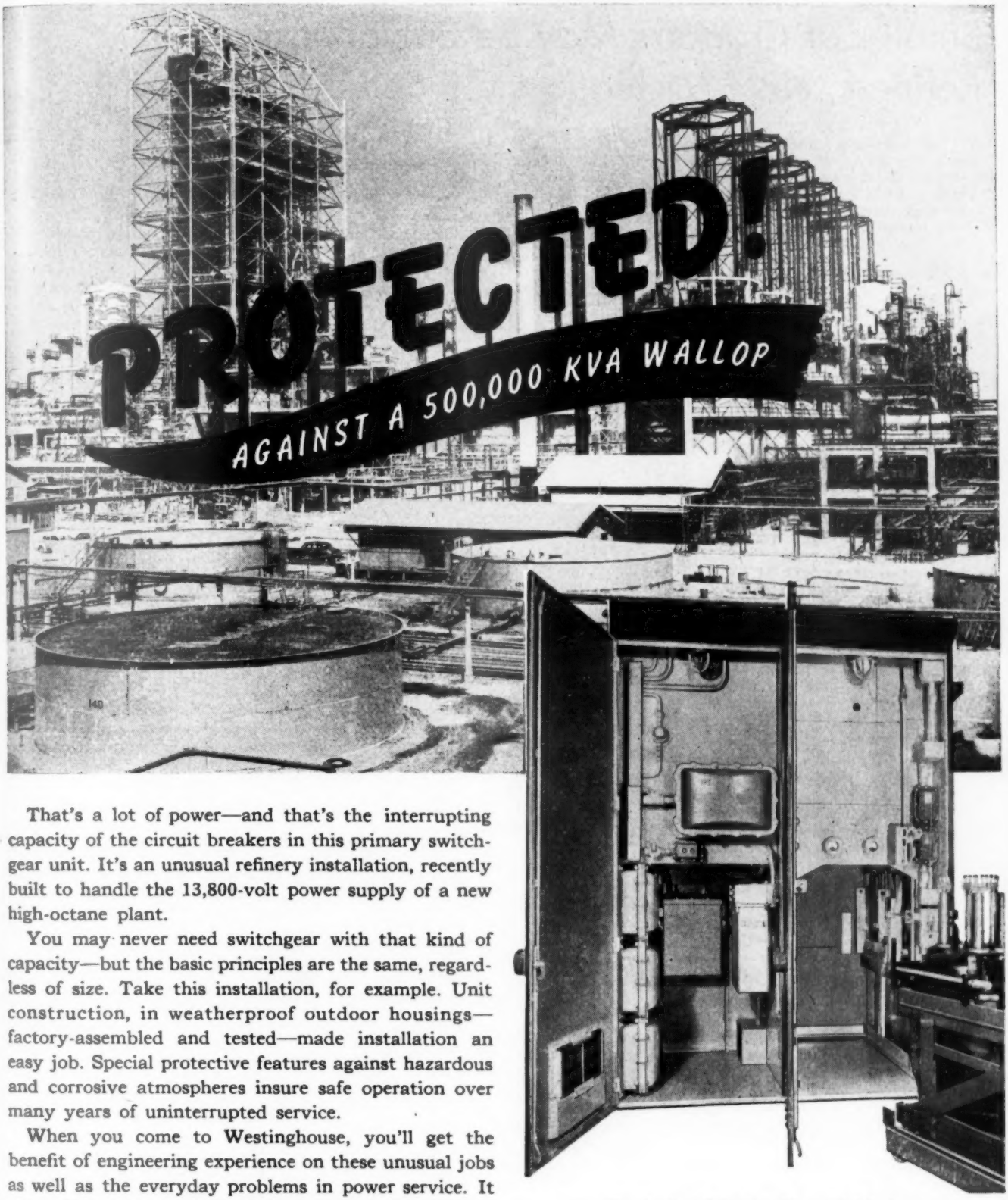
There was a decrease of 1,306,000 bbls. in domestic crude stocks and an increase of 149,000 bbls. in foreign crude. Heavy crude stocks in California totaled 4,570,000 bbls. up 164,000 bbls. from preceding week.

Major increases in domestic stocks were in Mississippi, up 159,000 bbls., and Illinois-Indiana, up 147,000 bbls.

Interior Report Delayed

NPN News Bureau

WASHINGTON — The Interior Department's report on the O'Mahoney-Hatch bill to amend the Mineral Lands Leasing Act of 1920 has been delayed. Holding up the report is a disagreement among Interior officials on a provision which would permit the secretary to set prices on royalty oil in excess of field market prices.



That's a lot of power—and that's the interrupting capacity of the circuit breakers in this primary switchgear unit. It's an unusual refinery installation, recently built to handle the 13,800-volt power supply of a new high-octane plant.

You may never need switchgear with that kind of capacity—but the basic principles are the same, regardless of size. Take this installation, for example. Unit construction, in weatherproof outdoor housings—factory-assembled and tested—made installation an easy job. Special protective features against hazardous and corrosive atmospheres insure safe operation over many years of uninterrupted service.

When you come to Westinghouse, you'll get the benefit of engineering experience on these unusual jobs as well as the everyday problems in power service. It pays off in more workable designs, more adequate protection—*at less cost*—and trouble-free performance. At your near-by Westinghouse office there's a qualified engineer ready to recommend the proper apparatus for your particular needs. Call him—*no obligation, of course*. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-94666

Standard switchgear with special features built for operation in highly explosive areas.

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Small Cat Crackers May Be Salvation for Little Refiners, NPN Michigan Field Survey Indicates

The following survey of Michigan and adjacent small refineries and problems they face in a peacetime world is the second of a series by Earl Lamm, NPN staff writer, who toured the territory personally. The Michigan area was selected because it is considered typical of small refiners in the United States.

By Earl Lamm
NPN Staff Writer

LANSING, Mich. — Development of large, expensive catalytic cracking units and their installation by major oil companies during the war years was closely followed by small independent refiners everywhere, who watched apprehensively from an untouchable distance as aviation gasoline production and octanes repeatedly climbed to new peaks—until the test tube finally ran out of octane numbers with meaning.

The independents realized their own plants were rapidly becoming outmoded and obsolete. Especially during the past year, when the war dragged out beyond its logical conclusion and peace constantly seemed within grasp, postwar thoughts were unescapable.

It appeared to many independent refiners that their doom was fixed because of the inevitable motor gasoline octane race to come. Their principal hope for continued existence lay in the prospects for a booming fuel oil market after peace, and a plentiful quantity of oil burners, arrive. There also was asphalt for projected new highway construction, and increased industrial use of other heavy petroleum cuts. But sale of those products has always been looked upon by the industry as "butter and egg" money —chicken feed residue after gasoline, the "money crop", had been harvested.

Temporary Palpitations

So it is not surprising that small refiners were subject to temporary palpitations, cold sweats, the ague, abject mental funks and other evidence of a failing destiny.

Ever-conscious of the needs of independent operators in every branch of the petroleum industry, NPN men, especially in the technical section, contacted refinery engineers and equipment manufacturers with frequent inquiries regarding the possibility of perfecting small, less expensive catalytic cracking units. Almost invariably it was found that certain of the more aggressive independent refiners were also pushing for new refining methods and up-to-date equipment, but manufacturers' hands were tied with big orders for big plants to fulfill big war needs.

Not until September was there any sign of a break for small independents, and progress in their behalf is now being reported. One of the operators of the 18 independent plants in Michigan, whom we called on near the end of our trip throughout the state, was in a happy mood.

"Say," he almost chuckled, "the price of small cat crackers is coming down! Maybe it will be within our reach!"

With the problem of better gasolines on the way to solution, it is important that all small refiners continually examine every detail of their whole operation, for grapes in the vineyard are of little benefit until they are disposed of at a profit.

As we mentally catalogue the plant setups and operations of the Michigan refiners whom we contacted, comparison with each other and exposure to thoughts collected elsewhere is inevitable. Each operation appears as a separate picture that might be hung on our office wall, and, thanks to the men we contacted, the pictures seem quite complete whether or not it is permissible to set down all thoughts here.

Leonard Drafts Program

Mr. Brazell

Reid Brazell, president, and L. R. Kamperman, vice president in charge of sales and general manager, described their over-all program for Leonard Refineries at Alma and St. Louis. Their sales force has just been strengthened by the addition of A. C. Sailstad, former chief of staff for the District 2 industry committees at Chicago. Previous to that he was with Standard of Indiana.

The amount of crude oil the Leonard Refineries owns, controls or has first call upon is fairly substantial, and the difference is made up through purchases from Leonard Pipe Lines and others, since the refineries are strategically situated near the heart of Central Michigan's best oil fields.

Crude capacity of the plant at Alma is 7000 b/d, with 1400 b/d thermal cracking capacity and 1500 b/d reforming, and a catalytic cracking unit yet to be added. The reforming unit has just been moved from Leonard's St. Louis plant to Alma, and plans for the continued use of the 4000 b/d skimming capacity remaining at St. Louis have not yet been fully settled, but it may be converted to the manufacture of special products. The PAW designated wartime "normal" for the Alma plant at 6940 b/d and present runs are 6900 b/d. The St. Louis plant was shut down during relocation of the reforming unit in August.

Whatever the Michigan refiners thought of Mr. Brazell's ability to obtain supplementary supplies of out-of-state crude for them during the war emergency, no one was found who accused the former chairman of the District 2 crude oil supply committee of trying to hog all the local supply for himself. He was frequently complimented during his industry committee service for his unselfish actions. Attempts were made to use West Texas sour crude at the Leonard Refineries, but, due to the plant setup, it was necessary to batch-run it, which proved too expensive.

Plant improvements have been numerous at the Leonard plants. They have a new asphalt plant recently installed, a new Petro-Chem furnace and have followed closely a general plant modernization program to keep abreast of new developments. They have built and are now equipping a new research and development laboratory for petroleum chemistry. Michigan crude and product possibilities are to be investigated to a greater extent than heretofore, and the new cat-cracker is expected to keep them up to date in the octane race. In their present breakdown of crude, they go from premium gasoline through kerosine, distillates and heavy fuels to asphalt, including road, industrial, binders, briquetting and asphalt for the paper industry. Several years ago they started making a special low-flash tractor fuel, which has developed a good volume of business, Mr. Kamperman said.

All Carry Leonard Brand

All products carry the "Leonard" brand, which shoots at top quality, and postwar prices are to be in line with those of major companies. Output of the small wartime codimer unit will be absorbed in the improvement of gasoline, and, with the new research laboratory, they expect to market many specialties in the petroleum chemistry field, which are particularly suited to manufacture from Michigan crude, according to Mr. Kamperman. They also have a midget polymerization unit. Their market area now is the state of Michigan, except on specialties, which are shipped greater distances.

A couple of years ago a department for market research and analysis was set up to determine what the postwar program should be. In explaining it, Mr Kamperman said:

"We made a market survey to estimate potentials on a scientific basis and have also gone to individual car owners through a mail survey to determine why they bought certain brands of gasoline and why they bought at certain service stations. The results are surprising."

The questionnaire form used by the Council for Market Development, Detroit, in making the survey for Leonard did not indicate for whom the poll was being made. Of those who replied, 52%

I owe it all to STEEL DRUMS
1st. PRIZE YACHT REGATTA
Seasoned yachtsmen know that, other things being equal, the boat with the smoothest hull wins the race. That calls for a sleek finish—with paint that's made right and kept right.

WHETHER PAINT IS USED on an 18-foot sloop or a 7-room house, it must retain its original sparkle and purity—just as it pours from the grinders at the factory. Preserving these qualities in paint, from maker to user, is largely the responsibility of steel containers.

Through trial and error, paint manufacturers have learned that only steel containers, such as Rheem makes, give the airtight security needed to prevent oxidation, and to keep the solvent from evaporating. And only the steel "package" can absorb the punishment a traveling container must take.

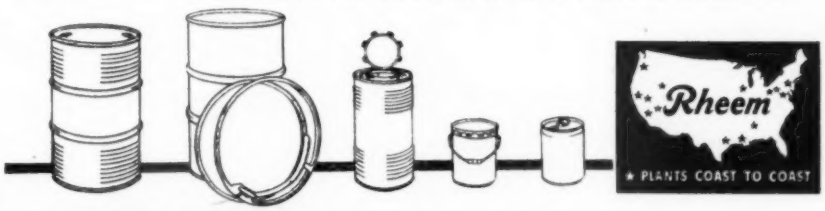
Rheem rugged-built steel containers have served a wide list of American industries since 1926. In a variety of sizes, gauges and linings, they protect products that range from the tough-bodied oil you put in your automobile to the delicate-flavored oil you pour on your salad.

When you want a container, remember that *inside and out* no other container protects like the steel drum or pail. And Rheem knows how to make the right steel container for your product.

* * *

Rheem drums, with Quik-Lox full-removable heads, on the filling line at a West Coast paint factory.

Your Product Deserves the Protection of a Rheem Container



RHEEM MANUFACTURING COMPANY

General Sales Offices

New York • San Francisco • Los Angeles • Chicago

The Aurora Gasoline Co.'s Dubbs' Cracker is located at Detroit. Above photo shows the pump room of the plant

lived in cities, 17% in towns, 13% in the country and 18% on farms. Before the war, 33% of them used their cars principally for driving to and from work, 6% for driving to and from town, 12% for pleasure, 13% for business trips and 36% for general transportation. Five per cent of the respondents said they bought only 25% of their gasoline at the same station prewar, 11% bought 50% at the same station, 61% bought 75% and 23% bought 100% at the same station.

With 84% of the drivers buying 75% or more of their gasoline at the same station, the Council for Market Development asked why. Full details on the response were not disclosed since surveys are expensive and top priority goes to the owner, but a few figures give partial comparisons. Of first importance, 550 drivers said they bought at the same station because they knew the station owner, 48 credited newspaper advertising; 81, radio; 21, free premiums; 42, road maps and 46, touring information. The principal figures missing concern the low price of gasoline and the driver's liking for the same brand of oil, but the 550 car drivers who knew and liked the station owners, places a premium on personality and service.

Done Through Jobbers

Leonard's marketing is almost all done through independent jobbers. The only bulk plant they have is at the refinery and they have only 18 scattered service stations under lease.

Another of the largest Michigan independent refiners who has been in business for about 14 years is Max M. Fisher of the Aurora Gasoline Co. at Detroit, which operates three refineries, although the Keystone Refinery and Aurora's plant at Detroit are located across the railroad tracks from each other and are operated as one plant, Mr. Fisher said. Crude capacity of the two plants is 6,500 b/d, with 3000 b/d of thermal cracking and 1,000 b/d reforming. The company has Great Lakes water-loading facilities at Detroit. Its other refinery is located at Elsie, Mich., convenient to the Sohio pipeline, and has facilities for making special cuts of naphtha, a Grey desulphurization unit for straight run gasoline, and a desalter.

Products turned out at the three plants are premium, regular and straight run gasoline—but no leaded third grade—kerosine and both light and heavy fuel oils. Products are unbranded and sales are through independent jobbers in Michigan, Ohio and Indiana. Aurora has no bulk plants or retail outlets, Mr. Fisher said.

At Muskegon, Ed Bowsma, president of Old Dutch Refining Co., said that with their capacity of 5000 b/d, the PAW allowable had been 2667 b/d and that they are running 2500 b/d of crude. He devotes a great deal of his time to oil production as they own or control about 2,000 b/d and while DSC transportation reimbursements were effective, they used about 500 b/d of West Texas crude. In addition to their own oil production efforts they often participate in the cost of wells drilled by others. More wildcatting was his suggestion for increasing the Michigan crude supply.

It happened that the day we called, a director's meeting was being held, but E. F. Sondregger, general manager, gave us some highlights on refinery operations.

Changed to Dubbs

They changed their plant from a true vapor base to Dubbs in 1942, he said and now have 2,000 b/d thermal cracking capacity. The second of two new topping furnaces was just being installed. In 1944, they put in a new laboratory and new machine shop. A new refinery bulk plant has also just been added. It has a capacity of 1800 gal. per minute. They are now dickering with U.O.P. for a desulphurizing unit. In fact, the vessels are being fabricated now, Mr. Sondregger said, and they expect to have the unit operating before the end of the year. During the war they made about 500 bbl. of codimer a month but are switching back to polymerization.

As to manufacture of specialties—"that depends upon whether or not the market gets lousy." "We will stay on reforming instead of cracking," Mr. Sondregger said, "and with Ethyl as long as we can to get the most out of a barrel of crude. Their regular run products are premium, house brand and straight run gasoline, kerosine, range oil, Diesel fuel, Nos. 2 and 3 furnace oil and residual fuel, which are sold under the "Old Dutch" brand, aimed at medium price markets with no change planned. However, they do intend to manufacture asphaltic road oils.

"It will be fortunate for the industry," declared John L. Dalson, sales manager, "if there is a turning away from concentration on gasoline manufacture by many small plants."

In his sales program is a thorough canvassing of independent jobbers and other prospects in their Western Michigan and Eastern Wisconsin trade territory, which they served prior to the war. They have no bulk plants or service stations and none are planned.

As for competition in the octane race, Mr. Dalson said for the immediate future they can manufacture up to 85 A.S.T.M. octane by installation of the desulfurizing unit in conjunction with their thermal cracking and poly plants.

"We have faith," he said, "that cat crackers will be available for smaller refineries as soon as automotive engines are built that require higher octane fuels."

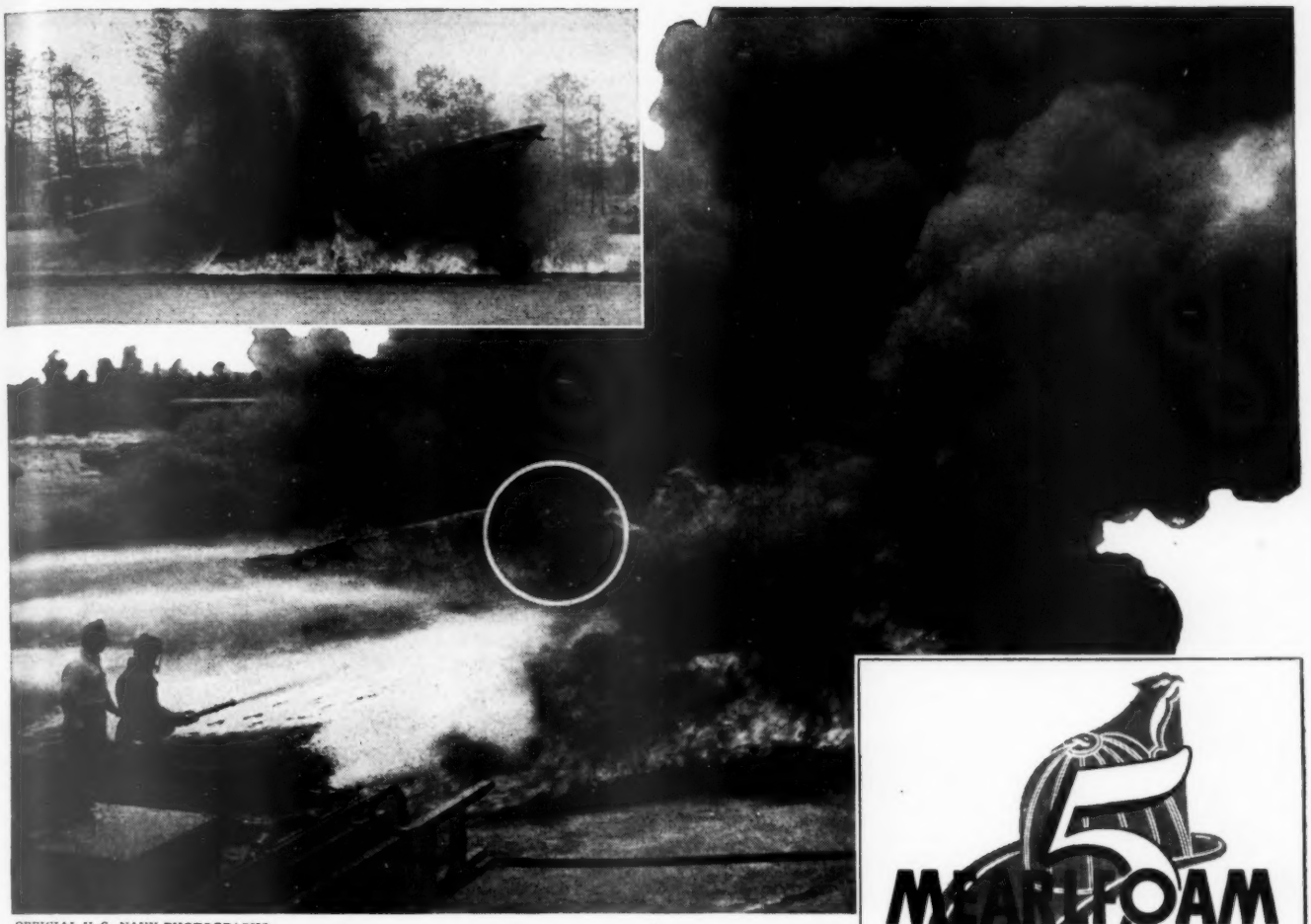
Crystal Refining Hard Hit

Crystal Refining Co. at Carson City was probably the hardest hit of all Michigan plants when the DSC freight payments and PAW allowables on crude were cut off. E. G. Guy, vice president and general manager, said that in August he ran a total of 93,000 bbl. of crude and that the September cutback was over 50. His July runs totaled 80,000 bbls., of which 30,000 bbls. was West Texas crude and 9,000 bbls. additional was a PAW allocation.

However, with arrival of October, Crystal's crude picture improved as arrangements were made for about 20,000 bbls. monthly of Deep River field crude to come by pipeline. This, said Mr. Guy, puts plant runs up to about 80,000 bbls. monthly once more.

The Crystal plant was built in 1935, with a capacity of 6,000 b/d, and the PAW normal during the war was 3,500 b/d.

A desalter was installed at the plant



OFFICIAL U. S. NAVY PHOTOGRAPHS

Safe Pathway to Inferno

TIME AND TIME AGAIN, fliers (see circle) have been lifted from their hot seats and carried to safety on carpets of voluminous, fire-resistant foam composed of myriad tiny bubbles *filled with air.*

Note how this war-born, blended multi-protein foam of high fluidity spreads rapidly over the fire forming a welded mat or airtight blanket. These official U. S. Navy photographs clearly illustrate how it beats back fire and holds it back.

MEARLFOAM-5 strangles the hottest gasoline or oil fire and remains a live, efficient foam blanket long after the fire itself is dead. It puts fire out and keeps it out. It quickly builds up a six- or eight-inch welded air-foam mat which seals out the oxygen on which fire feeds. It adheres to solid surfaces and will pile up an inch or two of fire-smothering dense foam on even perpendicular surfaces. Any break or rupture in the foam blanket heals automatically. Fire-resistance is maintained during aging.

The many unique and dependable properties of MEARLFOAM-5 are the sole reasons the U.S. Navy uses it extensively for preparedness . . . and for the quick extinguishment of raging gasoline and oil fires on shipboard and at shore bases. MEARLFOAM-5 is the veteran of many successful engagements, and now is ready to demonstrate to all—the super effectiveness of mechanical (air) foam as the most successful, modern method for combatting gasoline and oil fires.

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MEARLFOAM-5 is a good-mixer—with any type of water. It works at maximum efficiency in any climate or atmospheric condition. Always dependable.

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some time ago, but has not yet been connected, Mr. Guy said, adding that he will need it if he obtains a supply of Adams or Deep River crude. The desalter cost $2000 in advance and 1c per barrel run, but under his arrangement he has the privilege of bypassing it if he so desires. He has made no definite decision about a cracking plant, but said he would have a look at them when he got his crude supply arranged.

Products manufactured now are straight-run and third-grade gasoline, 46-49 kerosine, Nos. 1 and 3 burning oil, U.G.T. gas oil and residual fuel.

He regards Michigan, Ohio, Indiana, and parts of Wisconsin, New York and Pennsylvania as within his market range. "I have always shipped into that territory," he said. He has no bulk plants or retail outlets. "All sales are made over the desk here," he said. "A substantial amount of our gasoline goes to other refineries with reformers or catalytic crackers."

Commenting again on the need for crude, he said he would have just about enough now to take care of peacetime customers and would have no marketing problems. However, he wondered if there was likelihood of the Sohio pipeline being reversed again.

Roosevelt Oil May Step Up

Mr. Winter

At the Roosevelt Oil Co. in Mt. Pleasant, Vice President A. W. Winter said that, with their capacity of 6,000 b/d, their PAW allowable had been 4,500 b/d, and that if the markets and crude were found, they would step up runs to about 5,500 b/d. The associated company hookup with Simrall Pipeline indicates that Roosevelt's crude supply worries have never been very dire. They have frequently been a supplier of crude to supplicants on the District 2 list. However, Mr. Winter said new production was badly needed in the state and that in the past they had contributed to cost of drilling wells to some extent.

The refinery now has topping equipment only. "But we have been giving a lot of thought to cracking," Mr. Winter said. "Cat crackers cost a lot of money and take a lot of looking at," he added.

Doubtless since this interview, Mr. Winter has heard that the price of cat crackers has been cracked, and other small plants are finding the new cost figures interesting.

Products Roosevelt now makes are straight-run gasoline, 46-49 kerosine, No. 1 P.W. distillate, No. 3 straw, U.G.I. gas oil and No. 6 fuel.

"We aim at prices in line with those of major companies," Mr. Winter said. "We have no cut-rate service stations. We own 10 combination bulk plants and service stations and eight of them are leased out. No expansion in this direction is planned now," he said, "as we are close to both our crude supply and markets and probably market more products direct than refiners in some other areas."

As for specialty products, a few naphthas were made at times in the past and the field of specialties is being surveyed again, according to Mr. Winter. As for sales effort, he said they were doing the same as most refiners—rehabilitating their sales force. Maj. D. L. Conkright, who previously was in purchasing, has returned from overseas military service, and is now catching up on developments at home as sales manager as C. L. Butler, vice-president in charge of sales, is on doctor's orders for an extended leave of absence.

Roosevelt has had 68 men in military service, but many of them were young and worked only a short time before leaving, Mr. Winter said. In summing up, he added: "Everybody in Michigan is dusting off his hat and getting ready for return to normalcy, if that's what it is. Hope we can be as agile as independents are supposed to be!"

Capacity Was 2,200 b/d

Lloyd Wheeler, vice president and general manager of the Osceola Refining Co. at Reed City said their rated capacity was 2,200 b/d, but the former PAW allowable cut them down to 1350 b/d. Construction of the plant started in the fall of 1941 and it went on stream in the spring of 1942. Most they have been able to put through it so far is 1,750 b/d, and September runs probably will average about 1,000 b/d. He would like to move this up to 1,500 b/d, which would be a good, steady working average, he said, since he does not have too much storage capacity.

He is only a mile and a half from the Reed City pool, and has call on about 600 b/d of crude. Pipeline connections are Simrall and Leonard. The most crude he got at any time through PAW was 300 b/d and during recent months this dropped to 100 b/d. He has never used out-of-state crude. However, he has his own trucks and helps the pipelines move crude when a wildcat well comes in. Reed City could drill up enough 20-acre locations to hold production of the field steady if State conservation authorities decide to let the operators do it, he thought, as in recent months some special permits have been issued for 20-acre spacing.

Reed City is one of the best and largest pools in the state and in event the predicted surplus of gasoline shows up and prices are cut down, some refiners at a distance from the pool probably will be unable to afford their present crude purchases—that is, unless crude prices elsewhere drop too—which would leave more local crude for refiners in the central Michigan area. The same would apply if other plants develop out-of-state crude sources.

About plant improvements, Mr. Wheeler said no major changes were contemplated. About 50% of the equipment was new when the plant was built three years ago by combination use of equipment moved from the Glencoe refinery at Bloomingdale and relocation of their own plant at Wyman. However, more storage would be desirable, and two 10,000-bbl. tanks may be added for products. Since the plant is on the pipeline, there is sufficient storage for crude already.

Products made are straight-run gasoline, 47-49 kerosine, gas oil, Nos. 1, 2 and 3 burning oil by blending, and residual fuel, mostly under 300 vis. Products are not branded. Most of the gasoline is reformed at another plant on a straight sale and re-purchase basis, not a processing arrangement, Mr. Wheeler said.

No Naphtha Plans

Asked if he planned any special products, he continued: "I've heard of so many fellows going into the naphtha business, I want to stay away from that, for we have no trouble disposing of our fuel oil further north." He regards Northwest Michigan and upper Wisconsin as his market. The company does not own or operate any bulk plants or retail outlets. A couple of stations were built, but disposed of some time ago. The company merely sponsored their construction.

The Producers Refining Co., Inc., at West Branch owns one of the several skimming plants started in Michigan's boom days as a stock promotion project, but in the washout and change of management, it remained to become a substantial local enterprise. James P. Dunnigan, president, was an oil producer, who admits that in the beginning he knew so little about refining that he wasn't aware that gasoline is supposed to be the money crop, "so we began by making the things we had the most of," he said, "which was fuel oil and asphalt."

Mr. Dunnigan

The original crude capacity of the plant, built in 1936, was 2,000 b/d, which was increased to 3,500 b/d but not in time to get under the wire when PAW set the "normal" allowable runs at 1890 b/d. Consequently, Mr. Dunnigan was not in sympathy with the PAW restriction, especially since he had the necessary crude available. "PAW limited us to 1890 b/d," he said, "then shipped crude produced within 14 miles of us elsewhere." At the time interviewed, the PAW restrictions had not yet

been cancelled, but Mr. Dunnigan expected to step up his runs to 3,500 b/d, which he considered his normal operating capacity. He was one of the few refiners not worried about crude, as he was at work on an idea to overcome any lack.

Space Will Be Available

"As pipeline crude going East is stopped," he said, "that pipeline space will become available and Midcontinent crude will back up on other refiners in Southern Michigan and elsewhere and make more Michigan crude available to use," he said. "We have always operated on it."

It was a good prediction, for just that is already happening, as has been noted. West Branch owns producing properties which make about 10 per cent of the crude supply they need, Mr. Dunnigan said. The rest is purchased from Simerall, Leonard and Rayburn pipelines. However, they used about 500 b/d of Wyoming crude for a period of about six months during 1944, and a little this year. The West Branch oil field near by is declining about 7% a year according to Mr. Dunnigan. Plans are for the company to drill about six wildcat wells a year or support independent producers to that extent in their efforts, in order to keep production alive.

Refinery additions and improvements made since 1941, including new vacuum and oxidizing plants for asphalt, 1,500 b/d capacity and increase of storage capacity for crude to 50,000 bbls. and for products to 100,000 bbls. Another 30,000 or 40,000 bbls. of product storage capacity probably will be added soon, Mr. Dunnigan said, as the mechanics of operation would be much simpler with it. A new control laboratory is also planned.

Products now being made are straight run gasoline, kerosine, range oil, Nos. 1, 2 and 3 distillate, gas oil, residual fuel and a complete line of road oil, asphalt, asphalt cement, cold spray oil and wax distillates. The gasoline octane race is being watched for a while, Mr. Dunnigan said. Perhaps he will make 75-octane house brand motor fuel and about 60-octane desulfurized gasoline for farm trade, although this has not been definitely decided. Another product might be high-cetane diesel for general industrial and farm use.

"However, gasoline is a small part of our business," Mr. Dunnigan said. "Asphalt and burning oils are our main products as the gasoline content of our crude is low. We are set up to make naphthas, but hardly think we will."

The State of Michigan is regarded as a market, but the company always has shipped a few products out of the state for the convenience of regular customers.

Marked in Zones

North Michigan has been marked off in zones and jobbers and distributors are being brought into the plant and office for dinner discussions of manufacturing and marketing. First such meeting was held Sept. 5. The company has no bulk plants or retail outlets and none are planned, all sales being made through jobbers.

Mr. Stewart

Edward Reiser, former vice president and executive officer of Bay Refining Corp. sold his interest in the company and retired last spring, which is still news because he would permit no announcement when he left. So instead, we found W. R. Stewart, vice president, treasurer, general manager and oil producer, and Kenneth Patterson, secretary and sales manager, both of whom have a sense of humor, "ensconced in our nice new offices in Saginaw's only new skyscraper." The refinery is located at Bay City.

With an oil producer for general manager and another one for president—Fred Turner of Mt. Pleasant—no sign of serious crude worries was evident here. We understand that Mr. Turner contends that Michigan's oil possibilities are only 20% developed; however, both Mr. Stewart and Mr. Patterson agreed that the short term outlook for crude supplies for the state as a whole were fairly tight, and it is necessary for all operators to keep an eye on it.

The company's refinery went on stream in 1938, and is now skimming 4390 b/d of crude, which was the PAW allowable and close to its rated capacity of 4,400 b/d. Since it has been in full operation since built, plans have been drawn and are ready for construction of another topping unit, which will about double the capacity.

"This is a postwar plan as well as a recognition of the greater efficiency and economy possible in larger scale operations," Mr. Patterson said. "It also carries with it our belief that the domestic burner oil and the fuel oil market will be greatly expanded in the marketing area we serve.

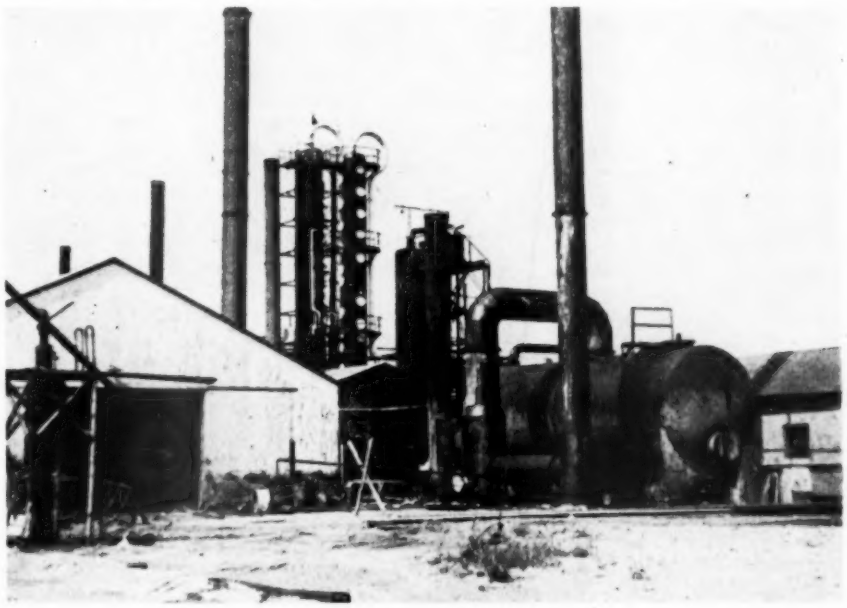
"We are also now building a gas recovery plant," he continued. "This plant will conserve gases now being lost in our present process, and will also enable us to produce butane and propane and a wide range of industrial naphthas in place of our present straight-run gasoline. This gives us a wider market than we have previously enjoyed, and we believe will meet a need for these new products."

Stressed Fuel Oil

The Bay refiners have always considered their present plant as a fuel oil maker, and products turned out are straight-run gasoline, kerosine, No. 1 P.W. and No. 3 furnace oil, gas oil and No. 6 heavy fuel. Products are sold unbranded, chiefly in Eastern Michigan and Great Lakes area from their marine terminal at Bay City. Some products were of course shipped east in wartime, but that is over and Mr. Patterson said that he expected to have to work harder for sales. OPA came around for a checkup sometime ago, he said, but afterwards told them their 'nose was clean.'

Another East Michigan plant that has stepped up its capacity is the Louis Rose

Asphalt Products Co. Being Expanded to Meet Demands



The asphalt plant of the Asphalt Products Co. (with the towers of the Producers Refining, Inc., in the background) was built to serve the war effort but is now being expanded to serve peacetime demands. The plant is located at West Branch

Co-partners in the Erie Refining Co. at Bloomingdale, Mich., are (left to right): Rae W. Lewis, Harry B. Crell, Max J. Lewis and Joseph J. Crotser.

Refining Co. at Saginaw. The 1,500 b/d skimming capacity has just been increased to 4,500 b/d with the addition of a slightly used thermal cracking unit brought from Minneapolis. Mr. Rose, who is a Plymouth-DeSoto automobile distributor in Detroit, said he bought the plant for his son, Palmer Rose, 20, who is now in the Air Corps at Gulfport, Miss., but ready to go to the Pacific. As soon as his son returns home, Mr. Rose said he himself would resign as president of the refining company and the boy would take that title and supervision of the plant. Mr. Rose said he owns or has the call on a total of 1,200 b/d of production and that an additional amount to keep the new plant capacity working had been arranged for with William Cline of the Lupher Drilling Co. of Columbus, Ohio. PAW normal for the 1,500 b/d wartime capacity was 780 b/d.

The company does not own or operate either bulk plants or service stations, Mr. Rose said, and he feels there is sufficient market within 50 miles of Saginaw to readily consume all of their increased output.

Hugh Goff, president of Petroleum Specialties Inc., operators of the 3,000 b/d skimming plant at Flat Rock just south of Detroit, said their PAW allowable was 1,725 b/d, but that since controls went off, runs had been increased to 3,000 b/d. They installed a Perco desulfurization unit the latter part of 1943, increased storage capacity for products, improved their lead-treating facilities, and plan to run their crude capacity up to 4,000 or 5,000 b/d. They already have the furnace capacity for that now, Mr. Goff said, but will need to re-arrange pumps and lines, and may need a larger charge pump.

He listed the products now being made as 75-octane regular, 47-49 kerosine, range oil, Nos. 1, 2 and 3 light oil, No. 6 heavy and mineral spirits. Other new products are planned, but not ready for announcement yet, Mr. Goff said. He regards the Detroit area as his market, but with the suddenness of peacetime operations had not yet gone into new marketing plans. They have no bulk plants or company operated service stations and are strictly refining, he said.

At Lakeside Refining Co., Kalamazoo, L. W. Brummitt, president, said their small 1,500 b/d skimming plant was not built until 1939, had a PAW normal of 1260 b/d, and he thought there would be no change for the present. He has the call on some crude in the field and has also leased a storage tank at Lansing on the Sohio pipeline from where he trucks a supplemental supply, however most of his crude, he said comes by tank car from Reed City. For about a year prior to last March, he said he used between 300 and 400 b/d of out of state crude.

Mr. Brummitt

Plant improvements include a lead blending plant put in in 1942 and a Perco desulfurization unit now being completed. With the decline in crude supplies and a buyers' market on gasoline, this is no time for further expansion, he said. Products made now are straight-run and house brand gasoline 46-49 kerosine, range oil, Nos. 1, 2 and 3 burning oil, gas oil and 18 to 20 gravity heavy fuel. Products are not branded.

"We may go into some special naphtha," Mr. Brummitt said, "but I really think that market will be flooded."

Southwest Michigan, north central and northeastern Indiana and northwestern Ohio are Lakeside's market areas, and Mr. Brummitt said they had had little difficulty selling all of their output.

"In southwest Michigan, we are strategically located," he said. "Crude costs us more delivered, but we get it back in better prices for products than usually prevail in central Michigan or Chicago." It seems that transportation costs into the southwest Michigan area are a bit higher than elsewhere, which weeds out some competition.

The Erie Refining Co. at Bloomingdale is near the Bloomingdale oil fields northwest of Kalamazoo. It is a co-partnership equally owned by Rae W. Lewis, Max J. Lewis, H. B. Crell and J. J. Crotser, according to Mr. Crotser. Crude capacity of the skimming plant is 2,000 b/d, the PAW normal was 1,500 b/d and since West Texas crude shipments were cut off, runs have dropped to 1,100 b/d.

"The crude outlook is not very good," Mr. Crotser said, "but we are working out a new deal with a pipeline company at Chicago for tank car shipments."

Discovered in 1938

Records kept by the Department of Conservation at Lansing show that the Bloomingdale field was discovered in 1938, is producing 42 gravity oil from the Traverse at 1220 ft. and up to Jan. 1, 1945, the accumulated production amounted to 5,987,855 bbls. However, in 1944, the field averaged only 335 b/d. Mr. Crotser said they have an interest in a small amount of the production. They used about 400 b/d of West Texas crude under the DSC compensatory plan.

Recent plant improvements include a desulfurization unit, a lead plant and 15,000 bbls. of additional storage bringing their capacity up to 50,000 bbls.

"We are as efficient as a skimming plant can be," Mr. Crotser said, "and there is not sufficient crude in this area for a cracking unit." The improvements mentioned were made in 1942 and 1943.

The given list of products being manufactured were 78-80 octane Ethyl, 74-76 octane house brand, 54-56 octane white gasoline, 45 kerosine, Nos. 1, 2 and 3 burning oil and residual fuel. The Ethyl, according to Mr. Crotser is made by giving their straight run a shot of lead and a shot of natural gasoline.

The market area is Southwest Michigan and as far north as the middle of the State and south into Northern Indiana and a corner of Ohio. Chicago and Detroit areas are passed up. At the present time most products go by transport. Sales activity has been stepped up through many personal calls to keep pace with what others are doing. Two large service stations are under company control, Mr. Crell, assistant sales manager said, and others have been discussed, but there are no plans for setting up bulk plants.

The remaining three independent refining companies in Michigan—Marvel and Midwest at Grand Rapids and Naph-Sol at Muskegon, are understood to be actively at work on problems similar to those of the other companies—crude, plant improvement and marketing. When the plan for obtaining Midcontinent pipeline crude from across Lake Michigan is worked out any crude worries they may have probably will be taken care of for sometime to come.

MARSHALL'S 60 MACKS HAULED MORE THAN 200 MILLION GALLONS OF OIL LAST YEAR!

An extraordinary story of truck performance is told in this letter from Mr. R. H. Anderson, president of Clare M. Marshall, Inc., of Rouseville, Pennsylvania:

"During 1944, our fleet of 60 Mack tractors and semi-trailers transported over 200 million gallons of petroleum products," Mr. Anderson writes. "They traveled 4,357,104 miles, predominantly through the tough, mountainous terrain of western Pennsylvania, operating on a 24-hour-a-day, 7-day-a-week schedule, regardless of weather. I can express complete satisfaction with the service and performance of these Mack Trucks."

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FOR EVERY PURPOSE
One Ton To Forty-Five Tons

Performance Counts

NPN Survey Reveals Extensive Extra Benefits Given to Employes of Major Oil Companies

NPN News Bureau

CLEVELAND—Major oil companies of the United States, which the Oil Workers International Union (C.I.O.) has tried to portray as greedy, soulless corporations, have exceptionally high wage scales. But more than that, they offer to employes, including union members, far-reaching additional benefits.

The high wages and the extra benefits add up to what is probably the most generous personnel policy of any industry in the nation.

Most of the companies have not told the story of these additional benefits to the public, though the petroleum industry was singled out by the C. I. O. as the starting point of an inflationary drive for 52 hours pay for 40 hours work and though strikes were called by the O.W.I.U. in violation of contracts and in violation of Federal law.

An exception was Sinclair Oil Corp. Harry F. Sinclair, president of the company, told of extra benefits available to Sinclair employes in a recent letter to stockholders of the company.

Mr. Sinclair's letter said:

"In addition to their wages, our employes are granted sick leave with pay (three weeks at full pay and 12 weeks at half pay), vacations with full pay (one or two weeks depending upon length of service), pensions and $1,000 life insurance, for which the company pays the entire cost."

To round out the picture, National Petroleum News asked other major companies, including some not involved in strikes, to tell what they offer employes in addition to above-average wages. Following is a summary of the replies:

PAN-AMERICAN PETROLEUM CORP.

Sick Leave—Minimum benefits, one week with full pay, two weeks with half pay after six months service; maximum benefits, 12 weeks with full pay, twelve weeks with half pay after 10 years service.

Vacations—Vacations with full pay for one or two weeks depending upon length of service.

Retirement—Employes may participate in company's retirement plan to which company and employe contribute.

Insurance—Life insurance $1750 to $10,000 (contributions by employer and employe), depending upon earnings. Accidental death and dismemberment, $750 to $5000.

Hospital and Surgical Benefits—$5 to $6 per day with $25 to $30 for additional hospital charges. Up to $150 for surgical fees.

STANDARD OIL CO. (OHIO)

Sohio Retirement Plan—(1) Number of employes presently on pension—334. (2) Normal retirement age—65 for men and 60 for women. Earlier retirement may be arranged under certain conditions, after age 55 for men and age 50 for women. (3) Employe contributions—2½% for salaries up to and including $250 per month; employes whose salaries are in excess of $250 pay 2½% on the first $250 and 5% on that portion which is in excess of $250. (4) Amount of pension is figured on employe contributions and is in addition to payments received from federal old age benefit. (5) Combination of Sohio retirement plan and federal old age benefits provides an approximate monthly pension equal to 2% of average monthly salary, times the number of years of service with the company.

Employe Group Life and Total Disability Insurance

Annual Earnings	Group Life Insurance	Employe Monthly Cost
Less than $1500	$ 1250	$ .50
$1500-$2000	2750	1.55
$2000-$2500	3750	2.55
$2500-$3000	5250	3.30
$3000-$5000	7250	4.70
$5000 and Over	13,250	8.90

In case of total permanent disability the employe is paid the full amount of policy in 60 equal monthly installments. Insurance can be converted without medical examination within 31 days after termination of employment.

Hospital Insurance and Surgical Benefits—(1) Daily expense benefits of $5 per day for hospitalization for injury, illness or an operation. (2) Maximum of $25 for additional charges. (3) Coverage from day of hospitalization to as much as 31 days for any one case. (4) Benefits for surgical operations up to $150 for an operation, according to fixed schedule.

Sickness or Accident Leave—Employes receive sick leave according to length service under the following table:

Length of Service	Sick Leave at Full Pay
6 months to 1 year	1 week
1 year to 2 years	2 weeks
2 years to 4 years	1 month
4 years to 6 years	2 months
6 years to 8 years	3 months
8 years to 9 years	4 months
9 years to 10 years	5 months
10 years or more	6 months

Notes: Enough leave at 2/3 pay is added to the full pay leave employe gets to have a total of 52 weeks for any job-caused accident or sickness. During a 5-year period employe cannot take more than the total full pay leave allowed for his last two years of service, counting back from when he is sick. See also Employes Mutual Benefit Assn. below. Any regular employe may be absent with full pay up to three days for death in his immediate family. Regular employe may be absent for two weeks during a year for jury duty, receiving full pay less jury fees.

Vacations—One week after completing one year of continuous service; two weeks each year after completing two years of continuous service; three weeks in the calendar year in which the 10th, 15th and 20th year of continuous service is completed; starting with year in which 25 years of continuous service is completed, three weeks each year.

Employes Mutual Benefit Assn.—After six months of service, benefits for non-occupational illness are made possible through Employes Mutual Benefit Association. Initiation fee of $1.50 and dues are equal to 1% of salary up to maximum of $1.67. This pays benefits equal to two-thirds of employe's regular wages, up to a maximum of $25.64 per week, for disabilities lasting seven days or more, and for maximum of 52 weeks in any continuous period of three years.

THE TEXAS CO.

While The Texas Co. did not submit details of its additional benefits for employes, it said that the company spends approximately $400 annually on each employe to cover accident and health insurance, pensions, paid vacations and other extras.

SHELL OIL CO.

Pensions—All regular and full time employes of the Shell Companies may become eligible for a pension derived from the principal and earnings of the funds accumulated in trust arising from contributions of the companies to the Shell pension fund. Employes do not contribute to this fund. Those eligible for retirement receive a full pension after having accumulated 20 or more years of accredited service and having reached the normal retirement age, which in the case of men is 60 years and women 55 years. Full pension equals 40% of an employe's average monthly compensation during his last five years of accredited service less federal old age benefit payments after age 65. Pensioners who are also members of the provident fund have their pensions adjusted by a factor representing earnings on the companies' contribution to that fund. Employes may under certain circumstances retire before meeting the above conditions on a proportionate pension.

Disability Benefits—Employes on the operating payrolls of Shell Oil Co. and Shell Pipe Line Corp. receive disability benefits when they are prevented by accident or sickness from performing their company duties. For disability absences employes are permitted benefit time each year up to 13 weeks based on years of service. The company assumes the full cost of the disability benefit plan.

Military Allowances—Military allowances have been granted to Shell Oil employes with one or more years of cumulative service prior to Dec. 8, 1941. A service allowance equivalent to an employe's normal salary for two months has been paid on his entering the armed services. In addition, employes having a wife or children were given a monthly family allowance. This allowance, which was the difference between company pay and military earnings up to 50% of the employe's normal wage or salary was designed to keep the family income as near as possible to that enjoyed by the family when the employe was in the service of the company. The company

also undertook to defray the cost of the premiums of the National Service Life Insurance equal to the amount carried in the companies' group plan.

Provident Fund—Shell employes are eligible to participate in the benefits of the Shell provident fund. This object of the fund is to assist employes in the accumulation of funds for use by them and their families after the retirement or death of the employe. Under the plan, the employe may elect to put aside a portion of his salary (10% after six years service) by means of regular payroll deductions, and the company will match it dollar for dollar. When he retires or leaves the company, he receives double his money, plus interest. (Those who leave prior to five years service receive only their own contribution, plus interest). The provident fund plan makes it possible for an employe to save a full year's salary every five years, at a cost to himself of only half that amount.

SOCONY-VACUUM OIL CO.

Sickness and Accident Disability Plan—Company pays the entire cost.

Vacations—From one to three weeks each year, depending upon length of service.

Annuities—Company has annuity plan under which almost 2500 persons now receive regular monthly benefits.

Educational Refund Plan—Company shares expense for courses in educational institutions for certain employes who have had at least one year's continuous service with the company.

UNION OIL CO. OF CALIFORNIA

Sick Leave—Employe is allowed one week of sick leave at full salary for each year of service with the company.

Retirement Plan—Company matches the contributions of employes under plan which sets the retirement age at 65 years for men and 60 years for women.

Vacations—One week paid vacation after year of service, two weeks with pay after two years of service.

Insurance—Company and employes contribute to two group life insurance plans.

Servicemen—Each employe leaving for the armed services given two months salary.

STANDARD OIL CO. (CALIFORNIA)

Annuity Plan—Provides for annual income at retirement of 2% of average annual earnings times the number of years of service. Plan was established more than 37 years ago. Company's contribution is considerably more than that of employe.

Insurance—Group life insurance, related to length of service, is paid for by the company.

Sickness and Injury Benefits—Full pay for periods ranging from two weeks to 26 weeks for employe who is sick or victim of nonindustrial accident. Industrial injury benefits also are provided to supplement industrial compensation. These benefits are provided by the company without employe contribution.

Vacations—Two weeks with pay after one year of service. Extra vacation plan provides that employes with 25 years of service get an extra three weeks of vacation with pay.

HUMBLE OIL AND REFINING CO.

Vacations—Employes with one year of service get one week with pay, two weeks after two years of service, three weeks after 15 years of service.

Jury Service—Company pays employes called for jury service at regular straight time rates and permits them to retain jury fees.

Military Service Payments—Men entering the armed forces after a year with the company given two months pay.

Extra Disability Benefit—In addition to amount of compensation provided by law in event of industrial accident, company pays additional sum so that employe receives full pay for 16 weeks.

Sickness Benefits—Following is schedule for sick benefits:

Years Service	Full Pay Weeks at	Half Pay Weeks at
1	4	2
2	4	7
3	4	12
4	4	17
5	8	18
6	8	23
7	8	28
8	8	33
9	8	38
10 or more	12	40

(Note: In certain instances employes with less than 3 years of service are not eligible to sickness benefits unless disability exceeds seven calendar days.)

Death Benefits—Beneficiaries of employes with a year or more of service are paid death benefits ranging from three months to 12 months of full pay.

Group Insurance—Made available to employes at low cost.

Annuity and Thrift Plan—Company matches dollar for dollar the first 3% of each pay check contributed to the plan by an employe; it matches the remainder of the employe contribution (up to 13%) on the basis of 50 cents for each employe dollar.

Indiana Standard Man to Be Chairman at S.A.E. Meeting

Special to NPN

NEW YORK—The program of S.A.E. national air transport engineering meeting Dec. 3 to 5 in the Edgewater Beach Hotel in Chicago, reveals that a main item of the discussion will be the engineering requirements of commercial air transportation over global routes, from ground servicing equipment and methods to navigation and traffic control.

General Manager John A. C. Warner, of the Society of Automotive Engineers, explained that the meeting will concentrate its attention upon basic, mutual and pressing engineering problems of the air transport industry. The general chairman of the meeting will be J. E. Kline of Standard Oil Co. (Indiana).

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U. S. Strategic Bombing Survey Shows How Nazi Lack of Oil Hastened Their Defeat

American Petroleum Powered The Planes Which Crippled Foe's Power To Keep Armies Rolling and Halt Allied March

NPN News Bureau

WASHINGTON—One of the most important uses of American petroleum products in World War II was in airplanes that struck at Germany's synthetic oil industry.

Those attacks cut like a surgeon's scalpel into the heart of Germany's power to fight in what was primarily an internal combustion engine war.

The American petroleum industry, in reviewing its war record (see article on PAW in this issue), should read with particular gratification the story of how the gasoline and lube oil they produced were used in strategic bombing to reduce Germany's ability to turn out these vital materials of war.

Last week the War Department made public "The United States Strategic Bombing Survey." Following are quotations from the part of the report dealing with the attack on Germany's oil:

Two Most Important Objectives

Measured in terms of results achieved, the two most important objectives were the German synthetic oil industry and the German transportation system. These were, in a sense, contrasting targets. From the beginning of the war oil had been a weak point in the German supply system. As early as 1942, shortages of aviation fuel had compelled the Germans to cut down the training of pilots, and it has been seen that this circumstance, as much as any other, eventually cost Germany control of the air over her own territory. Thus, in attacking Germany's synthetic oil plants, the Allies selected an existing bottleneck and sought to draw it tighter.

Transportation, on the other hand, was one of the strong points in the German economy. The importance of this target to the attackers lay in the fact that the maintenance of transportation was vital both to economic life in Germany and to the support of troops at the front. ***The attacks on oil and transportation contributed heavily to the collapse of the Reich.***

In 1938, the last full year of peace, Germany consumed approximately 7,500,000 tons of oil. On a per capita basis Germany used only one-fifteenth as much as the United States.

Her own crude production, centered largely in the area around Hanover, supplied only about 7% of peacetime needs; this small crude production, plus the production of synthetic plants, covered about one-third of her own requirements of liquid fuels before the war. The balance was imported. Substantial refining industry, operating largely on Venezuelan crude, had grown up in the Hamburg and Bremen areas. This dependence upon foreign crude was a constant worry to the German planners, and various steps were taken, beginning in 1933, to make Germany more nearly self-sufficient.

State subsidies were paid to encourage exploratory drilling within Germany, and crude oil production from German fields increased from 238,000 tons in 1933 to 1,052,000 tons in 1940. In addition, a synthetic oil industry was built which was largely owned and developed by private enterprise. It was directly aided by high tariffs on imported oil.

Broadly speaking, the operation of Germany's synthetic plants was based on her extensive deposits of coal, and these plants were concentrated in the Ruhr, in the central German area around Leipzig, and in Silesia. The synthetic plants were chiefly of two types: those using the Bergius hydrogenation process and those using the Fischer-Tropsch process.

The German plans called for the accumulation of substantial inventories, particularly of aviation gasoline for the German Air Force, and of Diesel fuel for the German Navy. When Poland was invaded, these stocks had not been attained. Germany started the war with 492,000 tons of aviation gasoline in reserve as compared with the planned figure of 1,500,000 tons, and 1,118,000 tons of Diesel and fuel oil as against the planned figure of 2,800,000 tons. At the outbreak of war, Germany had less than 6 months' supply of all liquid fuels based on wartime requirements.

Once war had started, the synthetic plants were enlarged so that in 1943, cut off as she was from Middle East and Western Hemisphere oil, Germany was operating entirely on her own relatively small production of crude oil, imports from conquered and satellite countries, plus the output of her synthetic industry. Production in Germany itself is shown in the table below, which shows the importance of the synthetic production, particularly for aviation gasoline.

The early campaigns imposed little burden on Germany's small reserve stocks of oil and, in fact, contributed to the supplies available. The early campaigns gave control of Polish crude-oil production and relatively small amounts in Estonia and Alsace. The blitzkrieg campaign against France and the Low Countries in May 1940 used relatively little oil; in fact, stocks of gasoline captured in France were larger than the amount used during the campaign. Hungary's signing of the tri-partite pact in November 1940 made available considerable additional production.

Likewise, Rumania was forced to export a larger share of its declining production to Germany until the occupation by the Russians in August 1944. In 1943 imports from Hungary and Rumania totaled about 2,000,000 tons, chiefly in the form of motor gasoline and Diesel oils.

Virtually all aviation gasoline production came from the hydrogenation plants, and 10 of the principal 18 hydrogenation plants (including iso-octane plants) produced 80% of the total aviation gasoline production. The synthetic plants using the Fischer-Tropsch process did not make aviation fuel. After the defeat in front of Moscow in December 1941, attempts were made to expand output of existing hydrogenation plants and also to speed up the building of additional plants, particularly at Brux (600,000), in the Sudetenland, and Blechhammer (400,000 tons) in Silesia.

Two large plants to produce iso-octane material essential for high-grade aviation gasoline were built at Heydebreck and Auschwitz, also in Silesia. The great plants at Heydebreck and Blechhammer did not come into substantial production because of bombing. The concentration of production in relatively few hydrogenation plants is attested by the following tabulation:

Total Production of Hydrogenation Plants, in 1943, of all Products

	Tons
Leuna	606,000
Politz	558,000
Gelsenberg	418,000
Brux	335,000
Bohlen	263,000
Zeitz	281,000
Wesseling	233,000
Scholven	231,000
Magdeburg	219,000
Welheim	137-000
Moosbierbaum	58,000
Ludwigshafen	55,000
Lutzkendorf	37,000
Total	3,431,000

The technical integration of both hy-

1943 Production of Oil Products in Germany

(Tons)

	Aviation Gasoline	Motor Gasoline	Diesel Oil	Fuel Oil	Lubricating Oil	Total
Hydrogenation	1,745,000	386,000	787,000	135,000	35,000	3,088 000
Crude Oil	4,000	150,000	429,000	53,000	767,000	1,403,000
Fischer-Tropsch	.....	254,000	99,000	.....	15,000	368,000
Coal Tar Distillation	.....	34,000	94,000	820,000	.....	948,000
Alcohol Plants	.....	18,000	.....	.....	.....	18,000
Benzol Plants	35,000	320,000	.....	.....	.....	355,000
Total	1,784,000	1,162,000	1,409,000	1,008,000	817,000	6,180,000

drogenation and Fischer-Tropsch synthetic-oil plants with the chemical industry made the synthetic-oil industry a particularly important target, and the bombing of this industry, and particularly Leuna and Ludwigshafen, had more far-reaching effects than the mere loss of oil production. Bombing of the synthetic-oil plants dealt a crippling blow to the munitions and explosives industries and severely affected the synthetic-rubber industry.

The Rumanian oil refineries at Ploesti were attacked in a number of daring and most costly raids by Allied planes operating from north Africa and Italian bases. A spectacular low-level attack made on August 1, 1943, had only a temporary effect. Deliveries of Rumanian oil to Germany actually increased until April 1944, when the attacks were renewed.

Starting in April 1944, raids on the Rumanian refineries, and the mining of the Danube, materially cut down the flow of oil to Germany, and set the stage for the all-out attacks on the synthetic-oil plants in Germany proper, which commenced in May of 1944.

While the major attacks were concentrated against the hydrogenation plants, the refineries in the Hamburg-Bremen area and the Fischer-Tropsch plants of the Ruhr were also bombed.

The first attacks against hydrogenation plants were made on Leuna, Bohlen, and Gelsenberg on May 12, 1944, followed by raids on Magdeburg, Lutzkendorf, Zeitz, and Leuna on May 28 and a raid on Politz the following day. The Germans quickly realized the seriousness of their position. Every protective means available was utilized. They took extreme measures to rebuild and repair the plants that were being knocked out. The great danger of attacks on these plants was early recognized by Speer, who stated that "the happenings of the 12th of May had been a nightmare to us for over 2 years." Following the raids in May and June, Speer wrote constantly to Hitler impressing upon him the necessity for protecting these vital plants with every resource possible.

Top Priority on Men, Materials Given to Repair Oil Plants

As an emergency measure Speer put Edmund Geilenberg in complete charge of repair, rebuilding, and dispersal of the bombed oil plants and gave him top priority on men and materials for this purpose. As many as 350,000 men worked day and night on this job. Plants that had been knocked out completely were brought back into production in relatively few weeks, thus necessitating renewed attacks. The history of Leuna in this respect is striking.

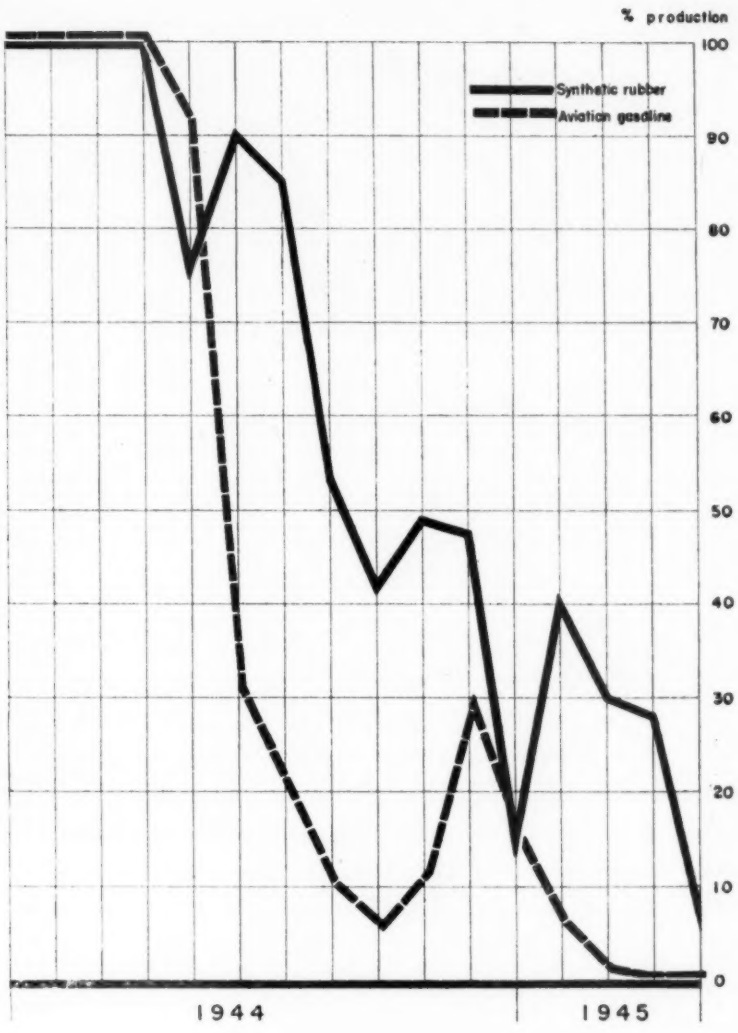
In May 1944, Leuna had a working force of approximately 35,000 men. The first attack on May 12 knocked out production completely. Geilenberg put several thousand additional men into the plant and partial production was resumed 10 days later. The raid of May 28 again knocked out the plant but production was resumed on June 3 and reached approximately 75% of capacity by the early part of July. The July 7 raid once again shut down the plant, but production started 2 days later and reached 53% of capacity by July 19. A raid on July 20 again caused a shutdown, but only for 3 days, and by July 27 production was back to 35%. Two raids on the 28th and 29th closed down operations once more, and continuing raids on Aug. 24, Sept. 11, 13, 28, and Oct. 7 prevented any production. In spite of this pounding and the accumulation of vast damage, operations were resumed on Oct. 14 and, while interrupted by a minor raid on Nov. 2, production reached 28% by Nov. 20. In spite of six additional heavy raids in late November and December, production came back to 15% in the middle of January 1945, and was maintained at an average of 15% capacity during March and early April.

The very rapid rate of recuperation achieved by the Geilenberg organization at Leuna and other synthetic plants was in part accomplished by cannibalizing equipment from badly bombed plants and from new plants under construction to keep other plants going and also in part resulted from taking manpower and materials from other important industries.

In general, repeated air attacks, rather than the severity of any single raid, caused the almost complete breakdown of German oil production.

Production turned sharply downward in May 1944. The military consequences are reflected in the figures showing the consumption of aviation gasoline by the German Air Force during 1944.

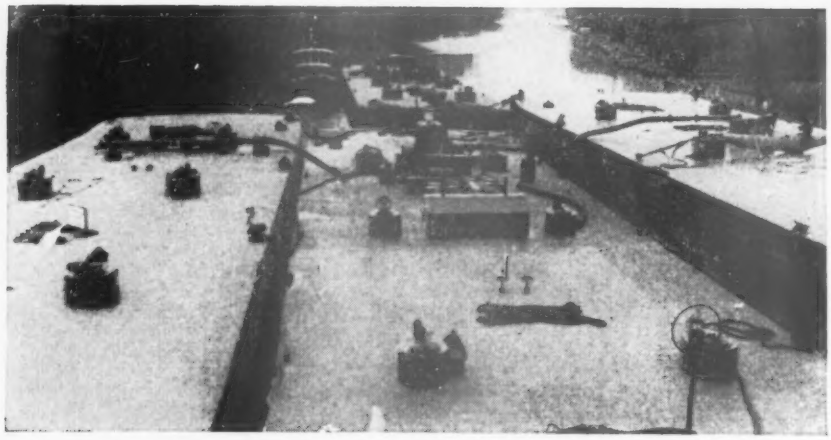
GERMAN GASOLINE AND RUBBER INDEX



AVIATION FUEL CONSUMPTION, 1944

January	122,000
February	135,000
March	156,000
April	164,000
May	195,000
June	182,000
July	136,000
August	115,000
September	60,000
October	53,000
November	41,000
December	44,000

Consumption exceeded production



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from May 1944 onward. Accumulated stocks were rapidly used up and in 6 months were practically exhausted.

The loss of oil production was also felt in many other ways. In August, 1944, the final run-in time for aircraft engines was cut from 2 hours to ½ hour.

By December, according to Speer, the fuel shortage had reached catastrophic proportions. When the Germans launched their desperate counteroffensive on Dec. 16, 1944, their reserves of fuel were far from sufficient to support the operation.

Gen. Bradley has described the situation on the western front in the closing months of the war as follows:

Lack of Oil Proved Fatal

With the defeat of the German gamble in the Ardennes, when the Allies were again in the position to resume the war of movement—in the East as in the West—lack of oil, which the strategic bombing campaign had enforced upon the enemy, told handsomely. The retreat from the Ardennes was an agonizingly slow and costly affair for the enemy. It took place against a background of painfully exiguous oil reserves—with supply trucks being drained to fill the tanks of fighting vehicles—and a long pull to the distant loading stations.

When the Allied threat shifted north to the Aachen sector, the enemy was unable to sideslip his "mobile" formations to meet it in the measure he sought—again for lack of gasoline. When the Allied break-throughs followed west of the Rhine in February, across the Rhine in March, and throughout Germany in April, lack of gasoline in countless local situations was the direct factor.

The results of the oil shortage made themselves felt also on the eastern front. The Russian victories in Silesia in February and March 1945 were hastened by the German lack of fuel. At the Baranov bridgehead 1,200 tanks, which had been massed by the Germans to hold the line, were immobilized for lack of gasoline and overrun.

Planned Program of Dispersal

The German program for the construction of jet-propelled fighter planes offered a ray of hope, since they did not require high-grade aviation fuel, but operated on J-2 fuel of the Diesel oil type, which was more readily available and easier to make. This was a factor in the decision, made in early 1944, to stop construction of additional hydrogenation plants and not to increase production of aviation gasoline in existing plants. The Germans did, however, plan for a substantial increase in the J-2 fuel, but other bottlenecks developed within the chemical industry so that the expansion contemplated did not materialize.

Speer and Geilenberg also planned a program of dispersal of small plants and a program of underground installations. They anticipated that 100,000 tons a

month of liquid fuel would be available from small dispersed plants and underground installations by the spring of 1945, but the war ended before any appreciable amount of production was obtained from these plants. During the war the German oil industry opposed attempting to put the hydrogenation plants underground and, in view of their size and complexity, it seems clear that any such program on a large scale was impracticable.

A major opportunity in the Allied air offensive against oil was unexploited. Ethyl fluid is an indispensable constiuent of high-grade aviation gasoline. The addition of Ethyl fluid in very small amounts to gasoline is so beneficial that no modern aircraft is operated without it. Ethyl fluid is made from tetraethylead and ethylene dibromide. There were only two tetraethylead plants in Germany; one plant in occupied France and two small plants in Italy.

Production of the Italian plants was never available to Germany and the production of the two German plants and the French plant was barely adequate to supply tetraethylead for Germany's fuel needs. Plans were made as early as 1942 for the construction of a new 400-ton-per-month unit in Heydebreck. It was planned to enlarge Capel from 100 to 200 tons per month, and to construct a new plant at Brixlegg, Austria. None of these plans ever materialized.

Two ethylene dibromide plants were available to the Germans—a French plant on the Mediterranean coast, which extracted bromine from sea water, and a German plant in Holstein. The French plant was never operated and the German plant was the sole source of ethylene dibromide for Ethyl fluid.

Eliminating from consideration the Heydebreck and Brixlegg plants, which were only projects, and the two Italian plants, whose production was as unavailable, there were only three plants supplying tetraethylead and one plant supplying ethylene dibromide. These plants were not bombed, although the equipment and processes used were such as to make them highly vulnerable to air attack.

FEA Petroleum Division Now In State and Commerce Dept.

NPN News Bureau

WASHINGTON — Functions of Foreign Economic Administration's Petroleum Division have been transferred officially to State and Commerce Department, although the division still is operating as usual and plans for absorption into these two departments have not been worked out.

Export control functions have been shifted to Commerce, while lend-lease, liberated area supply, and UNRRA activities are now under the State Department.

A. E. Ernst, division director, and Critchell Parsons, associate director, are working under the State Department in the new setup.

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FIG. 1

FIG. 2

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FIG. 3

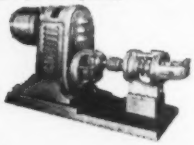

FIG. 4

The BUMP PUMP CO.
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List Compression Ratios For Some 1946 Models

Special to NPN

DETROIT—Compression ratios for a number of new-model passenger cars have been announced by motor makers, the ratios to be higher in some instances, the same in others. The available tabulation follows:

Model	Make	Ratio
	Buick	
40 and 50		6.3
60, 70 and 90		6.6
	Cadillac	
All models		7.25
	Chevrolet	
All models		6.5
	Chrysler, Dodge, DeSoto, Plymouth	

Compression ratios on the Chrysler group will be the same as last year with the exception of Plymouth, which may be a fraction lower. However, this is not official on Chrysler as yet.

	Ford, Mercury, Lincoln*	
Ford six-cylinder		6.7
Ford, V-8		6.6
Mercury		6.6
Lincoln V-12		7.0

*Ford specifically designates all current production as 1945-46 models.

	Hudson	
6 cylinder (3 in. x 5 in.)		6.5
8 cylinder (3 in. x 4½ in.)		6.5
	Nash	
6 cylinder (L-head)		7.0
6 cylinder (Valve-in-Head)		6.8
	Oldsmobile	
6 cylinder		6.2*
8 cylinder		6.2*

These ratios have been tentatively scheduled for first production. However, Oldsmobile is now continuing road tests with engines of 6.5 compression ratio and may soon adopt this higher ratio for standard production on both engines if available fuels appear to warrant its use.
*Tentative

	Packard	
110		6.71
120		6.85
160		6.85
	Pontiac	
6 cylinder		6.5
8 cylinder		6.5
	Studebaker	
Champion 6		6.5
Commander 6		6.5
	Willys	
Civilian Jeep		6.5

Ohio Service Stations Can Still Employ Women After Dec. 15

NPN News Bureau

CLEVELAND—Termination of the Ross Act Dec. 15 will not necessarily mean that women can no longer be employed in service stations, according to Hubert Fuller, general counsel of the Ohio Petroleum Marketers Assn. Mr. Fuller says the practice may be continued, with certain limitations.

The Ross Act modified or suspended for the duration of the war emergency many of the provisions of the Ohio labor laws, especially as they concerned the employment of females. Gov. Lausche has announcd that he will declare the emergency ended and the provisions of the act terminated Dec. 15.

During the war period of labor shortage, many women have been employed as service station attendants or operators. However, Mr. Fuller points out that service station operations are not included among the class of occupations in which the employment of females is prohibited in Ohio.

The O.P.M.A. counsel says certain provisions of the Ohio laws governing the employment of women must again be kept in mind beginning Dec. 16. Thus, girls between 18 and 21 may not be employed at service stations, or in any other capacity, before 6 a.m. or after 10 p.m. Women may not be employed more than six days in any consecutive seven days; and they may not work more than eight hours in any one day or more than 48 hours in any one week.

The Ross act suspended certain provisions relating to luncheon periods at service stations and relating to the length of shifts during which women might work continuously at service stations. After Dec. 15, under reversion to original labor laws, an employer is forbidden to employ a female for a period of more than five hours of continuous labor unless such period is broken by a meal period of at least 30 minutes, and if a lunch room is not provided separate and apart from the room where the female is employed, such meal period must be 60 minutes.

Asserts Texas Must 'Freeze' 'Gas' Tax For Highway Use

Special to NPN

AUSTIN—Texas must freeze her gasoline for use in building highways and roads from a standpoint of national defense, the Texas State Guard Officers Assn. was told here by Fred Knetsch, member of the Texas Highway Commission.

The past Legislature agreed to submit to the voters a constitutional amendment freezing the use of the retail gas tax and preventing the share now going to highway construction from being diverted to other purposes. Periodic attempts are made in the Legislature to divert this fund into pensions or other uses.

Mr. Knetsch said the main argument against diverting the highway fund is that highway construction is a long range proposition and that the Highway Department cannot make comprehensive plans for good roads in Texas unless it is assured of funds.

"To be able to plan effectively, highway administrators must know beyond any question of a doubt that a project started today and which will require five years to complete, will not be stopped in two or three years because of diversion of highway funds."

Texas oil companies have always been in the lead in opposing any diversion of the gas tax, since it is to their benefit to encourage use of motor vehicles by a good road system.

International Petroleum Exposition to Resume In Spring of '47; Many Queries Are Received

NPN News Bureau

TULSA — W. G. Skelly, president, has announced that the International Petroleum Exposition will be resumed in the spring of 1947. Dates for the first postwar show have been set for May 17 to 24, inclusive.

The Tulsa exposition, which was first held in 1923, has grown to be one of the largest single industry expositions in the world, and has not only been represented by nearly every major oil firm and associated industries, but has attracted huge exhibits and delegations from more than a score of foreign countries. Mr. Skelly indicated that the 1947 exposition will have even more foreign countries represented than in past years.

"We have already received several queries from foreign countries about the dates of the next International Petroleum Exposition," Mr. Skelly said. "These are in addition to foreign exhibitors and delegations of previous years. The development of foreign fields, greater recognition to oil producing countries, and the necessity for co-operation in locating and developing these new fields will be of primary importance in the 1947 exposition.

"Our South American neighbors are playing an increasingly important part in the world's petroleum industry, and many new opportunities for development are being realized by them. At the same time, many valuable oil fields of the world were destroyed during the war. Reconstruction of these fields in the immediate future is imperative. The International Petroleum Exposition will be an invaluable aid to representatives of these countries in future development of their resources."

William B. Way, general manager of the exposition, has been authorized by the executive committee to proceed immediately with plans for the exposition.

Mr. Way told the executive committee that the greatest problem in the 1947 exposition will be finding space to take care of the exhibitors. He said that with the growing interest in new development, and the large quantity of new equipment which will soon be on the market, the accommodation of exhibitors would be a major problem.

Attending the first meeting of the executive committee were: W. G. Skelly, president, Skelly Oil Co.; Alf G. Heggem, vice president of the Oil Well Improvement Co.; Frank J. Hinderliter, president, Hinderliter Tool Co.; W. M. Bovaird, president of the Bovaird Supply Co.; Frank O. Prior, president of Stanolind Oil and Gas Co.; Clyde H. Pape, oil operation; and Mr. Way.

Oklahoma Mid-Continent Assn. Division Elects Officers

NPN News Bureau

TULSA—All officers except one, were re-elected at the Kansas-Oklahoma division of the Mid-Continent Oil & Gas Assn. at its annual meeting here last week. H. E. Zoller, Derby Oil Co., Wichita, was elected vice president for Western Kansas, replacing E. B. Shawyer, Wichita, who declined the nomination.

Officers are: Frank M. Porter, Oklahoma City, president; L. G. Owen, Tulsa, first vice president; Carl Weiner, Chanute, Kans., vice president for Eastern Kansas; A. W. Ambrose, Bartlesville, vice president for Northern Oklahoma; Lloyd Noble, Ardmore, vice president for Southern Oklahoma; W. R. Wallace, Oklahoma City, vice president for Western Oklahoma; and Clarel B. Mapes, Tulsa, secretary-treasurer.

Oil & Heat Institute Plans Industry Exhibit in April

NPN News Bureau

NEW YORK—The regular meeting of the board of directors of the Oil and Heat Institute of America was held here recently with 26 of 28 members present. The president, W. A. Matheson, reported he had talked with the pricing section of OPA and learned that their field work, which will determine whether or not an increase will be granted to manufacturers of oil burning equipment, is completed.

The board considered at some length replies to a questionnaire with reference to a national industry exhibition and approved an exhibition to be held in Philadelphia, April 23-27, 1946, with non-members invited to exhibit. An exhibition committee was appointed consisting of President Matheson, as chairman; W. A. Kemp, chairman of the accessory division; C. R. Jonswold, chairman of the distribution division; Fred Haab, director from Philadelphia and John A. Morrison, managing director of the Electrical Assn. of Philadelphia.

D. T. Staples Heads California Independent Natural Gas Assn.

NPN News Bureau

LOS ANGELES—The executive committee of the newly organized Independent Natural Gas Assn. of California last week elected the following officers: David T. Staples of Pacific Western Oil Corp., president; H. A. Eklund of British American Oil Producing Co., vice president; Rush M. Blodget of Blackfoot Petroleum Co., secretary-treasurer; and A. E. Bell, Jr. of A. E. Bell Corp., assistant secretary-treasurer.

The new president was authorized to appoint a committee of three members to formulate a natural gas policy, covering such subjects as conservation of gas and wide variation of prices in given areas.

Mid-Continent Oil Assn. Meeting Changed to Dec. 18 in Tulsa

NPN News Bureau

TULSA, Okla.—The Mid-Continent Oil and Gas Assn. Board of Directors meeting originally scheduled for Dec. 14 here has been changed to Dec. 18 at the Tulsa Club Roof Room, Tulsa Building.

Clarel B. Mapes, association secretary, also announced the following division meetings:

Kansas-Oklahoma — annual membership meeting and meeting of executive committee in Tulsa, Oct. 30.

Mississippi-Alabama — annual membership meeting and session of Board of Directors, Nov. 6 in Jackson, Miss.

Annual federal tax forum of Mid-Continent Assn. and annual meeting of standing committee on federal taxation, Dec. 4-5 in Tulsa.

Louisiana-Arkansas, Mid-Continent Assn. — annual membership meeting and annual session of executive committee, Dec. 10, Shreveport, La.

Petroleum Division of Mining, Metallurgical Institute Meets

LOS ANGELES—The American Institute of Mining and Metallurgical Engineers held its annual fall meeting, a joint session of the Industrial Minerals Division and the Petroleum Division, at the Ambassador Hotel here recently.

The Petroleum Division program was arranged by T. A. Atkinson of General Petroleum Corp. R. L. Parsons of Standard Oil Co., Carlton Beal of PAW served as chairmen with M. C. Turner of Union Oil Co. and C. F. Gates of General Petroleum Corp. as co-chairmen.

Separate technical sessions were held all day and climaxed with a joint dinner meeting in the evening at which Irving Borders, assistant regional manager for the Pacific Southwest Division of the Committee for Economic Development, addressed the engineers on the problems of reconversion.

Boosted Postwar Distribution Goal of C. of C. Meetings

NPN News Bureau

WASHINGTON—Special to the nation's distributors: Would you like to reach a postwar business goal 30 to 50 % above the best prewar level you ever achieved?

The United States Chamber of Commerce has scheduled five regional marketing conferences where leading American business men will suggest concrete ways and means to such an end. They are planned at:

Sacramento, Calif., Feb. 11; Dallas, Tex., Feb. 18; Atlanta, Ga., Feb. 21; New York City, Feb. 25 and 26; and Chicago, Ill., March 4.

Agendas include: distributors' reconversion problems, consumer credit, distributor-manufacturer relations, personnel in distribution, surplus property disposal, federal fiscal policy and taxation, and advertising and sales promotion.

Committee Members Differ on Views Pertaining To Creation of Peacetime P.I.W.C. Group

Special to NPN

CLEVELAND—Mixed reaction came last week from members of the committee of 23 appointed by P.I.W.C. Chairman Boyd to look into the creation of an organization to perpetuate co-operative industry spirit brought about by the war experiences of P.I.W.C. (See NPN Oct. 31, p. 8).

A number of the members of this committee told NPN they had not yet had an opportunity to give consideration to the organization. Several of the 23 members expressed approval of the principles upon which such an organization should be based, but preferred not to comment until the committee has had an opportunity to give more consideration to the plan.

The statements of some members follow:

H. A. LOGAN, NATIONAL PETROLEUM ASSN.: "The spirit of co-operation within the oil industry which was attained during the war period was most gratifying and played an exceedingly important part in making it possible for the industry to meet all government requirements for petroleum products for war purposes in all parts of the world. It would be splendid to have this same spirit continue during peace time insofar as it may be legally possible to accomplish this result through a new organization to supplant the P.I.W.C. As to ways and means of doing this, mature consideration must be given the problems involved, and I prefer to withhold any further expression of views on the subject until after consultation with the board of directors of the association which I represent which has not yet been possible."

J. C. HUNTER, MIDCONTINENT OIL AND GAS ASSN.: In his personal opinion, there should not be a new industry organization created to succeed the P.I.W.C.

B. L. MAJEWSKI, DEEP ROCK OIL CORP.: "The most important unfinished piece of business now confronting the petroleum industry is peacetime continuation of the spirit of unity which characterized this industry's wartime performance. A new petroleum industry council without any governmental counterpart can enrich and enhance the reconversion period for the welfare of the public and the industry as well. Its function will be to deal with National policy questions and kindred subjects permitted by law. The underlying principle to be followed in establishing it is to assure all the functional phases of the industry and all segments, large and small, comprising these functions equitable representation on the council. The council properly and lawfully organized on a functional committee basis can render unified industry advisory counsel and assistance to the Army-Navy Petroleum Board, the International Commission created by the Anglo American Petroleum Agreement, and the Interstate Oil Compact Commission."

B. A. HARDEY, INDEPENDENT PETROLEUM ASSN.: "I think that fear on the part of units in the industry of possible violations of Harrison Anti-Trust law might destroy its effectiveness. I think it quite necessary that data and statistics should be compiled by some central authority and made available to the public and the industry, and that a forum for the discussion and determination of common problems should be set up. This might be done through an expansion of the functions of the Inter-State Oil Compact Commission without new national and state legislation."

G. L. ROWSEY, GULF COAST REFINERS ASSN.: "In view of probable attitude of Department of Justice, do not believe there should be any new industry organization. Believe A.P.I. fills needs."

H. L. THATCHER, NATIONAL COUNCIL OF INDEPENDENT PETROLEUM ASSNS.: "I am of opinion that a permanent overall council would be of great value in matters of National and International importance to petroleum industry and to consumers of petroleum products. The P.I.W.C. membership comprises the most representative group of all segments of the industry that has ever existed. Since only an emergency could bring such a group together again, it would be most unfortunate if it were not used now as a nucleus around which to develop a permanent organization representing entire industry."

B. BREWSTER JENNINGS, SOCONY-VACUUM: "I have not thought matter through as yet, but believe that idea has great merit, provided such an organization would be truly representative of all elements in the industry, and the scope of its activities properly defined."

Postwar PIWC Plan Endorsed by Ickes

NPN News Bureau

WASHINGTON — PAW Ickes this week endorsed industry-sponsored proposals for a postwar PIWC as "very well worth considering," said he definitely would appear at the Senate Judiciary Committee's tidelands hearings Dec. 4 and 5, urged strengthening of the Interior Department's Petroleum Conservation Division, and once more denied any intention of resigning.

At a press conference devoted largely to oil, Mr. Ickes also:

1. Said Senator E. H. Moore (R-Okla) was "more ignorant than deceptive" when he charged Mr. Ickes was either "deceptive or ignorant" in disclaiming knowledge of British sterling area restrictions on an American oil firm.

2. Said he didn't know if President Truman's wage-price policy would have any effect on oil prices, and that he hadn't had time to consider a PIWC resolution asking his help in obtaining removal of price controls.

3. Said Interior Department was willing to encourage secondary recovery work, but that it was largely up to oil field operators.

4. Said maintenance of stripper well production was a "national problem that ought to be solved in the national interest," but didn't know how it should be solved.

5. Said PIWC's resolution concerning changes in regulations applying to royalty oil was not within its jurisdiction, but that he would receive it "respectfully."

6. Said he had been trying for more than a week to "bring the heads together of some people in the department" on changes in oil and gas leasing laws.

Mr. Ickes had not heard that PIWC appointed a 23-man committee headed by W. Alton Jones, Cities Service, to consider postwar government-industry co-operation and an organization similar to PIWC. Informed of it, he said:

"If the proposal comes from outside of government, it is very well worth considering. And if 'Pete' Jones has been named to head the committee, you can be sure there'll be something done."

The oil boss reported progress was being made in developing methods of exploring the continental shelf, but said the old government "Valentine" land scrip could not be used to acquire mineral-bearing lands off the California coast.

Asked if it were true that in 1933 he endorsed a legal opinion holding that tidelands rightfully belonged to the states, he admitted a blunder and replied:

"I am like LaGuardia. When I make a mistake it's a beaut."

Mr. Ickes said he didn't know what part Tommy Corcoran (ex-New Deal brain-truster) had in the tidelands issue. When reporters insisted that Mr. Corcoran did have some part, Mr. Ickes said he "wondered what was that fly on my wall."

The Interior chief said he thought the Petroleum Conservation Division should be at least a depository for "valuable" PAW records, and should serve in a greater advisory capacity. But he added that he had no concrete proposals.

On the matter of his resignation, Mr. Ickes said:

"That cat has more than nine lives. It has nine lives every week. And besides, I don't like cats."

Told of newspaper reports that Ed Pauley, reparations commissioner and California oil man, would succeed him, he cracked:

"Has he been measured for the toga yet?"

Asked if the report worried him, Mr. Ickes replied:

"Not in the least."

COMPLIANCE SERVICE ON OIL REGULATIONS

Digest of Regulations Issued Weekly Regarding Oil and Oil Equipment

Index of Week's War-Oil Orders

(October 27-November 3, 1945)

PAW—Petroleum Administration for War

Press Release—Restrictions removed on foreign petroleum supply and transportation

OPA—Office of Price Administration

MPR 88, Am. 36 — Ceilings on Brockton, Mass. kerosene and distillates and Buffalo, N. Y. No. 6 fuel oil

RMPR 136, Order 506, Am. 1—Only power-operated gasoline dispensing pumps covered by Order 506

Order 523—Ceilings on repair parts for Fort Worth spudders

Rev. Proc. Reg. 4, Am. 3—Rationing suspension orders

RO 1A, Am. 111—Minor changes in tire rationing order

WPB—War Production Board

Directive 36, Revocation — New and used commercial vehicle rationing ends Dec. 1st

Supp. Directive 1-F, Revocation—OPA implementing of ODT policies abandoned

Supp. Directive 1-O, Revocation—Authority of OPA over fuel oil rationing revoked

Supp. Directive 1-S, Revocation—OPA's control over stove rationing revoked

Notice to Filers of Reports under Pri. Reg. 8—Reports to be filed with CPA

Pri. Reg. 28 as am. 10-25-45 — Restricted priorities assistance for non-military purposes

Pri. Reg. 31, Am. 2 to 10-1-45 version — Blanket revocations

Pri. Reg. 32 as am. 10-29-45—Inventory rules

L-63, Am. 1—Additions to List A items

L-219, Direction 1 — Additional items excluded from report requirement

M-201, Revocation — Petroleum products preference rating exclusion order abolished by Pri. Reg. 31 blanket revocation

M-300, Schedule 71 as am. 10-29-45—Ethyl alcohol restrictions

Certificates 38, 51, 128, 140, 190, and 200, Revocation—Revocation of certificates to obsolete ODT orders

ODT—Office of Defense Transportation

AO ODT 1, Partial Revocation—Power of ODT officials partially rescinded

AO ODT 6B, Revocation—Order establishing Highway Transport Dept. regions revoked

AO ODT 30, Revocation—Revocation of delegation of authority to Highway Transport Dept. Director

Executive Orders

No. 9651—Post-war wage increases

Treasury Department

Press Release—Reduced work week compensation

Office of Stabilization Admr.

Rulings on New Wage-Price Policy — Explanation of President's wage increase policy

FEA—Foreign Economic Administration

Disposition of FEA Affairs—Termination of FEA and transfer of functions to other departments

Department of Commerce—Office of International Trade Operations

Blanket and Special Licenses, Revocation—FEA blanket and special licenses for export of technical data revoked

Gen. Export Regs., Am. 94—Prohibited exportations

Am. 95—Export of technical data

Am. 96—Revocation of general license for metal drum and container export

Am. 97—Partial shipment provisions revoked

Am. 99—Blockade control permit

Current Export Bulletins 286 and 288—Revisions and relaxation of export controls

WSA—War Shipping Administration

Gen. Letter 100—Tanker Allocations Division superseded by Tanker Division

Telegram to Tanker Owners—Termination of charter parties on over-3,000-gross-ton vessels

SPB—Surplus Property Board

Reg. 1, Am. 3—RFC's name inserted in place of Dept. of Commerce

Dept. of Agriculture

WFO 35, Termination—Rapeseed oil restrictions abolished

OIL-LAW-GRAM Service

Complete texts of all orders or amendments digested in oil orders can be had from Platt's Oil-LAW-Gram. 1213 West 3rd street, Cleveland 13, Ohio. Minimum charge single copies $1. Copies of these texts are always in stock but large orders can be promptly filled by reprinting as plates and stencils are also kept.

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Digest of Week's War-Oil Orders

Petroleum Administration for War

RESTRICTIONS REMOVED ON FOREIGN PETROLEUM SUPPLY AND TRANSPORTATION—Press Release—PAW has been advised by WSA that enough tankers will be available after 10-31 to meet unrestricted world requirements. Subcommittees for North Africa, West Africa, Near East and Far East, Latin America, and European supply are discontinued, as well as Bulk Tonnage Co-ordinating Committee. Directive 70 will be retained not later than Dec. 31st, to permit completion of programs and shipments already begun. Issued 10-29, effective 11-1.

Office of Price Administration

CEILINGS ON BROCKTON, MASS. KEROSENE AND DISTILLATES AND BUFFALO, N. Y. NO. 6 FUEL OIL—MPR 88, Am. 36—Establishes a Buffalo Area (Erie and Niagara Counties) delivered-at-destination tank car and transport truck ceiling of 5.3c gal., the same level existing prior to 9-1-45. Tank wagon ceilings, to carry out the customary industry differential, are set at 6c per gal. Brockton tank wagon ceilings are .2c higher than Boston area ceilings on kerosene, range oil, and Nos 1 and 2 fuel oil. The .3c gal. increase on fuel oil (products covered by RO 11), extended to 10-31-45, is again extended, to permit completion of OPA study of current price structure. Issued 10-31, effective 11-1.

ONLY POWER - OPERATED GASOLINE DISPENSING PUMPS COVERED BY ORDER 506—RMPR 136, Order 506, Am. 1—Ceilings set by Order 406, allowing a 9.2% increase over 10-1-41 price apply only to power-operated pumps. Issued 10-26, effective 10-27.

CEILINGS ON REPAIR PARTS FOR FORT WORTH SPUDDERS—RMPR 136, Order 523—Resellers are allowed the 6% increase granted to supplier, the Well Machinery & Supply Co., Inc. Regular discounts and allowances apply. Issued 10-29, effective 10-30.

RATIONING SUSPENSION ORDERS AND DETERMINATION OF VIOLATIONS—Rev. Proc. Reg. 4, Am. 3—Procedure for hearings concerning alleged rationing violations amended to prescribe procedure for holding a "determination proceeding", instituted to ascertain whether there has been a violation of a rationing regulation or order. Suspension and determination proceedings may be joined, and one hearing held for both proceedings. This order applies only to hearings held by a Hearing Commissioner, and not to suspension or revocation proceedings before War Price & Rationing Boards or Special Hearing Offices. Issued 10-26, effective 10-31.

MINOR CHANGES IN TIRE RATIONING ORDER—RO 1A, Am. 111—Manufacturers' wholesale regional branches and sectional warehouses may now total up to 100, instead of the former total of 75. Tire transfers may now be made in American Samoa without prior approval of Commodity Administrator for American Samoa. Issued 10-26, effective 10-27.

War Production Board

NEW AND USED COMMERCIAL VEHICLE RATIONING ENDS DECEMBER 1st —Directive 36, Revocation — Conforming to termination date of ODT control over vehicle rationing, WPB directive establishing new and used commercial vehicle rationing ends December 1st. Issued 10-30, effective 12-1.

OPA IMPLEMENTING OF ODT POLICIES ABANDONED—Supp. Directive 1-F, Revocation—Issued and effective 10-30.

AUTHORITY OF OPA OVER FUEL OIL RATIONING REVOKED—Supp. Directive 1-O, Revocation—Liability for infringements during time rationing was in effect not cancelled by this revocation. Issued and effective 10-30.

OPA'S CONTROL OVER STOVE RATIONING REVOKED—Supp. Directive 1-S, Revocation—Issued and effective 10-30.

REPORTS TO BE FILED WITH CIVILIAN PRODUCTION ADMINISTRATION—Notice to Filers of Reports under Pri. Reg. 8—Reports required under Pri. Reg. 8 are now to be filed with the Civilian Production Administration, or its agent, instead of the WPB. Issued 10-25.

RESTRICTED PRIORITIES ASSISTANCE FOR NON-MILITARY PURPOSES—Pri. Reg. 28 as am. 10-25-45—Added to list of cases where CC rating may be assigned by WPB is the case of machinery and equipment essential to the continued operation of a plant, needed in an emergency to replace equipment which has broken down and is not repairable, or to replace equipment condemned by public authority or insurance underwriters as unsafe, and which is not repairable, or the case of a bottleneck item needed for plant operations at the minimum economic rate most of the equipment being obtainable without priorities assistance. Other cases added are bottleneck items on construction of non-veteran homes, repair parts needed to prevent breakdowns of essential plant equipment and items to be incorporated into products to be delivered on a CC rating. Issued 10-25.

ADDITIONS TO BLANKET REVOCATION —Pri. Reg. 13, Am. 2—Restrictions on methanol, controlled by Schedule 72 to M-300, are

CODE: AO—Administrative Order; CMP Controlled Materials Plan: D—Directive; FDO—Food Distribution Order: GMPR—General Maximum Price Regulation: GO—General Order: Interp.—Interpretation; L—Limitation Order; M—Conservation Order; MPR—Maximum Price Regulation; P—Preference Rating Order; PAO—Petroleum Administrative Order: Pri. Reg.—Priorities Regulation: Proc. Reg.—Procedural Regulation; PS—Price Schedule; RO—Ration Order; RPS—Revised Price Schedule; SO—Supplementary Order; SR—Supplementary Regulation.

revoked. Issued and effective 10-31.

INVENTORY RULES—Pri. Reg. 32. as am. 10-29-45—Lumber added to list of materials subject to specific inventory provisions. Added to list of exempted materials and products are iron and steel piping system valves, except the lubricated plug type. Issued 10-29.

ADDITIONS TO LIST A ITEMS—L-63, Am. 1—Gas and electric ranges are among articles added to List A (exemptions from inventory restrictions and from monthly report requirements). Issued 10-25.

ADDITIONAL ITEMS EXCLUDED FROM REPORT REQUIREMENT—L-219, Direction 1—Gas and electric ranges excluded from controlled merchants' computations under L-219, except for purpose of determining whether they are "controlled merchants." Issued 10-25.

PETROLEUM PRODUCTS PREFERENCE RATING EXCLUSION ORDER ABOLISHED BY PRI. REG. 31 BLANKET REVOCATION—M-201, Revocation—Issued and effective 10-22.

ETHYL ALCOHOL—M-300, Schedule 71 as am. 10-29-45—Restrictions on rubbing alcohol removed from ethyl alcohol control order. Issued 10-29.

REVOCATION OF CERTIFICATES TO OBSOLETE ODT ORDERS — WPB Certificates 38, 51, 128, 140, 190, and 200—Revocation—Issued 10-4, filed 10-24, effective 11-1.

Office of Defense Transportation

PARTIAL REVOCATION OF POWERS OF ODT OFFICIALS—AO ODT 1, Partial Revocation—Delegations of authority referring to Division of Petroleum & Other Liquid Transport and its administration of tank car traffic movement is revoked effective 10-29. Delegations of authority to Highway Transport Dept., Division of Motor Transport, and Division of Local Transport revoked effective 12-1-45. Issued 10-29.

ORDER ESTABLISHING HIGHWAY TRANSPORT DEPT. REGIONS REVOKED—AO ODT 6B, Revocation — Order outlining Highway Transport Dept. rations, districts, and field offices revoked. Issued 10-29, effective 11-1.

REVOCATION OF DELEGATION OF AUTHORITY TO HIGH TRANSPORT DEPT. DIRECTOR—AO ODT 30, Revocation—Issued 10-29, effective 11-1.

Executive Orders

POST-WAR WAGE INCREASES—EO 9651—Three cases outlined in which Stabilization Administrator must approve wage increases which have been found by NWLB or other designated agency to correct a maladjustment. Employers are not prevented from putting wage increases into effect and thereafter applying for approval which will enable them to apply for price ceiling increases.

Treasury Department

48-HR. WEEK INCREASES GRANTED TO MAINTAIN SUPERVISORY DIFFERENTIALS CONSTITUTE AN INCREASE UNDER 40-HR. WEEK—Press Release—This type of salary increase requires approval unless it will not be used as basis for seeking price ceiling increase or for resisting otherwise justifiable reductions. Concrete examples are cited. Issued October, 1945.

Office of Stabilization Admr.

EXPLANATION OF WAGE INCREASE POLICY OUTLINED BY PRESIDENT—Rulings—Outlines, in question and answer form, administration's general policy on wage increases stated in Executive Order 9651, *above*. Issued 10-30.

Foreign Economic Administration

TERMINATION OF FEA AND TRANSFER OF FUNCTIONS TO VARIOUS DEPARTMENTS—FEA Disposition of Affairs—Transfer of personnel, funds, property and records to RFC, Depts. of State, Commerce, and Agriculture and to the former Army-Navy Liquidation Commissioner (now part of Dept. of States), is set forth in detail. Issued 10-25.

Dept. of Commerce—Office of International Trade Operations

FEA BLANKET AND SPECIAL LICENSES FOR EXPORT OF TECHNICAL DATA REVOKED—Revocation of Certain Blanket and Special Licenses—Issued 10-29, effective 10-30.

PROHIBITED EXPORTATIONS—Gen. Export Regs., Am. 94—Cotton tire cord, benzol or benzene, phthalic anhydride, agricultural and industrial insecticides removed from list. Camelback, GLV dollar value limits changed to 25 in both K and E country groups. Issued 10-24.

EXPORT OF TECHNICAL DATA — Gen. Export Regs., Am. 95—Detailed instructions as to conditions under which technical data may be exported. Different rules apply to that transported by mail, express, freight, telegraph, personal messenger, and specific requirements are outlined as to translation of foreign-language documents and patent application material.

REVOCATION OF GENERAL LICENSE FOR METAL DRUM AND CONTAINER EXPORT—Gen. Export Regs., Am. 96—Issued 10-25, effective 10-31.

PARTIAL SHIPMENT PROVISIONS REVOKED—Gen. Exports Regs., Am. 97—Partial shipment provisions in rules for individual license weight and volume tolerance are revoked. Issued 10-25, effective 10-31.

BLOCKADE CONTROL PERMIT—Gen. Export Regs., Am. 99—License applications will hereafter be accepted by Dept. of Commerce, Office of International Trade Operations. A number of items are removed from Spain's blockade control permit list, including carbon black, copper sulfate, and various ores and scrap metals, as well as scrap rubber. Issued 10-25, effective 10-31.

REVISIONS AND RELAXATION OF EXPORT CONTROLS—Current Export Bulletins 286 and 288—Explanations outlined as to purpose and effect of various amendments to the export regulations, *reviewed above*. Issued 10-25 and 10-30.

War Shipping Administration

TANKER ALLOCATIONS DIVISION SUPERSEDED BY TANKER DIVISION—Gen. Letter 100—Tanker Allocations Division abolished effective 10-26-45, and duties transferred to Tanker Operations Division, hereafter to be known as Tanker Division. Issued 10-31.

TERMINATION OF CHARTER PARTIES COVERING TANK VESSELS OF OVER 3,000 GROSS TONS—Telegram to Tanker Owners—Formal notice given of termination of charters on such vessels, in time or bareboat form, to 53 company-owners. Issued 10-17, effective 11-1.

Surplus Property Board

NAME OF RFC INSERTED TO REPLACE DEPT. OF COMMERCE—SPB Reg. 1, Am. 3—RFC replaces Dept. of Commerce (formerly Treasury Dept.) as disposal agency. Issued 10-19, effective 11-5.

Department of Agriculture

RAPESEED OIL RESTRICTIONS ABOLISHED—WFO 35, Termination—Issued 10-31, effective 11-1.

$1,000,000 Worth of Surplus Petroleum Products to Be Sold

NPN News Bureau

WASHINGTON — Surplus petroleum products acquired by the government at a reported cost of almost $1,000,000 will be offered for sale by RFC between Nov. 9 and 19, through informal written bids.

Offering includes lubricating oils and greases for automotive, aviation and industrial uses; gear lubricants; naphthas and solvents; waxes and petrolatum, and wide range of miscellaneous products in large quantities.

Bids will be received by RFC Regional Offices, and goods will be sold f.o.b. place of location. Some products are available for immediate sale, but offers received on most will be held until Nov. 19, at which time thy will be considered.

When Is a Jobber Not a Jobber?

(Continued from page 6)

service stations and as few as one, through which it sold as much as 29.4% of its total gasoline and as little as 6.5%. The particular "sins" which the commission pointed out consisted of selling to one service station customer at a cent below the going Standard dealer tank-wagon market, and to another at ½c below that market.

Wayne Oil Co. was classified as a jobber beginning in 1935. Up to 1939 the company operated no service stations of its own, but since then has operated from 2 to 6 such stations, selling from 7.6% to 14.2% through its own stations. This customer apparently resold to other service station operators at the going Standard tank-wagon price, a feature of its operations which seems to gain the commendation of the commission.

Stikeman Oil Co. bore the jobber classification from 1932, although at that time it sold only through its own service stations. It discontinued service station operation in 1938. The company also is credited with having charged the full Standard dealer tank-wagon price on all sales to service station operators.

Ned's Auto Supply Co., the other customer involved, classified as a jobber since 1938, sold all of its purchases direct to the public through its own service stations. The commission says it "has been the practice of" this company "to sell its gasoline below the prevailing retail service station price or to give premiums and discounts from its posted price.

Pretty Vague

A thorough consideration of the commission's sixteen pages of findings and two-page order leaves one with a great deal of wonder as to just what the commission is driving at, and in a complete quandary as to what practices of the industry it is attempting to change.

There have been some comments, but, as indicated above, they appear to be in the field of speculation. It would seem incumbent upon Standard to appeal to the courts, and then it will be some time before we know the limits the court will set on industry practice.

They can hardly be expected to tell suppliers they must control the method of sale and prices on products after they are sold to the original customer, things which the commission seems to indicate should be done, and things which the commission as well as others have frowned upon for years.

It's probably too early for the industry to frame all of its questions under the order, or even to frame any questions. It has been said the order is a threat to the existence of all jobbers who do a service station business in addition to supplying other service stations; no mention whatsoever is made of the type of operation where the jobber does a consumer tank-wagon business, and that

is a big part of the business of most jobbers, except for some in metropolitan areas.

One wonders whether or not the commission is fumbling around trying to find a formula for quantity purchases which will mark price differentiation. OPA has tried that in setting specific ceiling prices on aviation gasoline.

Under the Robinson-Patman Act the commission has some possible grant of authority to do something along that line. The act provides the commission "may, after due investigation and hearing to all interested parties, fix and establish quantity limits, and revise the same as it finds necessary, as to particular commodities or classes of commodities, where it finds that available purchasers in greater quantities are so few as to render differentials on account thereof unjustly discriminatory or promotive of monopoly in any line of commerce and the foregoing shall then not be construed to permit differentials based on differences in quantities greater than those so fixed and established".

Identical Prices?

If refining companies take the commission at the full value of what it might mean to say, is there a likelihood they will establish prices for jobbers and service station operators which are identical? If they do, they'll very seriously upset the oil jobbing industry as it has been known in this country.

If such handling were accomplished by raising the present jobber price to the dealer price, there would still be room for the refiner who supplied jobbers exclusively to sell below that level; but there's a question as to how long it would take competition to bring all prices down to the lowest level.

If there is to be a difference between the jobber price and the service station price, must the former be allowed only to those jobbers who do not operate service stations? If that be the case, then present jobbers would be compelled to choose between disposing of their tank-wagon business or of their service station business. They might do the latter under the Iowa plan, by leasing them out to other operators.

A full consideration of the findings of the commission is necessary in order to understand the manner in which the commission refused to be convinced by Standard's cost studies.

It will have been noted the law provides differences in selling prices are permissible where they make only due allowance for differences in the cost of manufacture, sale, or delivery resulting from the differing methods or quantities in which commodities are sold. Standard attempted to justify under this provision, but the commission wasn't the least bit impressed with the manner in which Standard approached the problem or the results it presented.

Standard also attempted to justify its practices by evidence that what it had done was to meet prices offered by competitors; the commission wasn't impressed by the thought.

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Sun Oil's 'Dynafuel' to Be Sold at Modern-Age Stations

Streamlined Installations Only Small Part of Firm's Vast Expansion in Postwar Years

By Frank P. S. Glassey
NPN Staff Writer

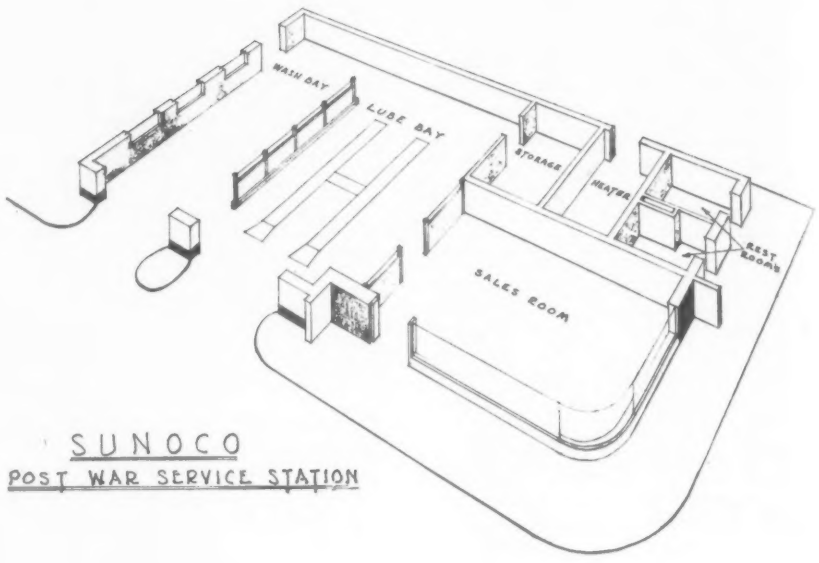
PHILADELPHIA—A $20,000,000 expansion program, including proposed construction of 400 new service stations at a cost of $10,000,000, was announced here last week by Sun Oil Co. The announcement coincided with unveiling designs for new stations and disclosure of performance statistics on Sun's new postwar gasoline, "Dynafuel," placed on sale in 18 states this week.

"Dynafuel," according to Arthur E. Pew, Jr., Sun vice president in charge of manufacturing and research, has a road octane rating of 85 plus, and will power 97.9 per cent of all cars on the road today without an incipient knock. The highest octane rating for a prewar Sun fuel was about 80.

The familiar blue tint of Sun gasolines will be continued in "Dynafuel," the only gasoline sold at Sun stations. In discussing the new product, Mr. Pew said it could be stored for several years with no change except a slight deterioration in color.

Outlined Plans

Sun's postwar expansion plans were outlined by Samuel B. Eckert, vice president in charge of marketing. Mr. Eckert said within the next year the company will build 400 new stations, each costing $15,000 or more, at a total expenditure of $10,000,000; will purchase $1,000,000 of trucks, of which $700,000 worth have already been ordered; will spend $2,000,000 to $4,000,000 in plant expansion, and has already purchased between $5,000,000 and $6,000,000 in land and leased other sites for service stations locations. He added the company intends to remodel and rebuild some existing stations.



To Create 2000 Jobs

The new stations, Mr. Eckert said, will create approximately 2000 new job opportunities. Few, if any, will be under direct company operation.

"Instead," he said, "they will represent the establishment of some 400 new independent businesses of high character. Anyone who carries on a gross business of $50,000 to $100,000 a year is no piker."

Sun intends to double its present marketing staff, and is contemplating terminal enlargement in principal areas including New York, Philadelphia, Baltimore, Detroit and Syracuse.

The new service stations, Mr. Eckert said, will be operated chiefly by war veterans. He estimated an operator should have between $3000 and $3500 to start in business, and his annual turnover should be at least $50,000. Sun will continue handling its own brand of

Sun Plans 400 of These New, Modern Streamlined, Postwar Service Stations

Sun Oil Co.'s postwar service station, of which 400 will be built during the coming year, creating approximately 2000 direct new job opportunities. Sun's service station program, when completed, will exceed the $10,000,000-mark. It is part of an over-all plan for an expansion and rehabilitation of marketing facilities

batteries and, according to Mr. Eckert, is seriously considering its own brand of tire. The new stations will contain motor tune-up equipment, but are not designed for major repairs. Merchandise on sale, aside from automotive equipment, will consist only of "repeat" lines, such as electric light bulbs.

The model of the proposed new station shown by Sun contemplates a salesroom 15 x 21 feet in the larger stations, 10 x 15 feet in the smaller. The facing of the model itself is of glass, but the company is building three experimental stations: one with a glass facing, one of enameled iron, and one combining the two materials. Within a few months they hope to determine the best construction.

"In designing this station," Mr. Eckert said, "we tried to build eye-appeal with the same clean, simple lines that serve best the functions we expect the station to perform. Outwardly, the station clearly shows by its design two of the main functions—service and what we call TBA merchandising, or simply the sale of tires, batteries and accessories—yet at the same time the design integrates the two into a compact unit.

High Visibility

"Inside, high visibility and convenience for the operator to increase servicing efficiency were the principal considerations. We believe both objectives have been achieved. Supply lines for compressed air, gear oils and chassis lubricants extend from the ceiling within easy reach of the operator, thus keeping the floor space clear, as well as improving the appearance of the servicing bay. The working stock of merchandise, visible from both the front and one side of the station, as well as from the servicing bay, takes the place of window displays."

The standard station will have two double pumps, and corner stations will have four. Pumps will be lower and more streamlined, following the general trend. Washrooms are on the side of the building.

Mr. Pew, in a discussion of postwar motor fuels, said the art of petroleum refining has developed ahead of engine design to such an extent fuels can be provided for any automobile offered to the motoring public in the foreseeable future.

"Just as we outran the octane scale in connection with aviation gasoline, so, too, octane number no longer is the controlling factor in the manufacture of motor fuel," Mr. Pew said. "All good gasolines today, as a matter of routine, should be knockless."

He added at the present stage of automotive engine development, other characteristics, such as starting, rate of acceleration, smoothness of performance and economy in operation, make up the postwar yardstick for the measurement of quality.

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Market Reports

MIDWEST—Refiners' prices remained unchanged during the week. Chicago marketer entered posting of 6.375c on 80 oct. Ethyl gasoline and 5.5c on 75 oct., withdrew price of 6.375c on 78 oct., 5.375c on 70-74 oct. and 3.5c on No. 2 straw, all FOB Group 3, and reported quoting 4c on 41-43 and 4.125c on 42-44 w.w. kerosine FOB Shreveport. Another marketer reported lowering quotations F.O.B. Group 3 as follows: from 4.625c to 4.375c on 41-43 w.w. kerosine, 4.125c to 4c on range oil, 3.875c to 3.75c on No. 2 straw, and 3.75c to 3.625c on No. 3. Still another marketer reduced his 78 oct. price from 6.5c to 5.75c; 41-43 w.w. kerosine price from 4.375c to 4.25c; his 42-44 w.w. kerosine price from 4.5c to 4.25c, and entered quotations of 4c on range oil and 3.5c on No. 2 straw, F.O.B. Group 3.

° ° °

MIDCONTINENT—Flat price of 4c on range oil in East Texas was changed to range of 3.875c-4c when refiner entered the low posting. Same refiner reported sales of 25 cars No. 1 fuel oil at 3.75c for movement over balance of October and November into Group 3 territory in Seller's tank cars.

Gasoline demand throughout Mid-continent area had picked up "considerably" refiners reported. Demand for No. 1 fuel increased in Kansas and Oklahoma. Kerosine and burning oils moved in good volume, most being sold for northern shipment. One East Texas refiner reported he was getting many inquiries for kerosine, but wouldn't sell while price was so low.

A total of six cars Grade 26-70 natural gasoline was reported sold F.O.B. Breckenridge at 3.5c throughout week. One car sold at 4.5c Group 3; refiners quoted 4.5c.

° ° °

WESTERN PENNSYLVANIA—Prices unchanged. Heavy call for all products reported in both upper and lower fields. Refiner in lower field said he was having difficulty taking care of his regular trade. Kerosine and No. 2 fuel oil demand "picking up" due to approaching season—stocks available but "not too plentiful." Gasoline supply "fair". A tremendous demand reported for neutrals and cylinder stocks with supply in tight position due to scarcity of crude oil. Untreated naphthas in somewhat better position as refiner reports having recently been able to buy some for plant use. Petrolatums exceedingly tight with demand in excess of supply.

ATLANTIC COAST—Supplier in the Wilmington area withdrew his price on 70-72 oct. gasoline eliminating posting altogether at that point. Kerosine demand reported to be "picking up" along the Atlantic seaboard due to approaching winter season with stocks in tight position throughout the southern area. Florida and Virginia suppliers report. No. 2 fuel oil stocks reported to be in "good shape" along seaboard. Gasoline supply "fair". Residual oils still critically tight in New York area due to transportation and past strikes at the Gulf Coast. One supplier reports the situation likely to last through the month of February as production and resources not sufficient to take care of present needs.

° ° °

GULF COAST—Prices firm at current posted levels. Refiners report heavy demand for all products with supplies limited due to refinery strikes in this area a few weeks ago. An increasing heavy demand for bunker "C" fuel oil noted. Gasoline reported to be in tight position and one refiner said he barely had enough to take care of his regular trade.

° ° °

CALIFORNIA — No price changes. The indication of a weakening in the gasoline market as a result of a price cut by an independent company was not evident last week. Market conditions remained unchanged, gasoline is plentiful and the Diesel market is steady.

NPN Gasoline Index

	Dealer T.W. Cents Per Gal.	Tank Car Cents Per Gal.
Nov. 5	9.96	6.60
Month ago	9.99	6.59
Year ago	10.38	6.73

Dealer index is an average of "undivided" dealer prices, ex-tax, in 50 cities.

Tank car index is weighted average of following wholesale markets for regular-grade gasoline, FOB refineries or terminals: Okla., Mid-Western, W. Penna., Calif., N. Y. Harbor, Philadelphia, Jacksonville, Boston and Gulf Coast.

Summary of Daily Gasoline Prices (October 29 to November 5)

U. S. Motor (ASTM octane)	Monday Nov. 5	Friday Nov. 2	Thursday Nov. 1	Wednesday Oct. 31	Tuesday Oct. 30
78-80 octane Ethyl:					
Oklahoma	6.75	6.75	6.75	6.75	6.75
Mid-Western (Group 3 basis)	6.75	6.75	6.75	6.75	6.75
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7	7	7	7	7
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	7 - 7.125	7 - 7.125	7 - 7.125	7 - 7.125	7 - 7.125
E. Tex. (Truck Tnsp.)	7	7	7	7	7
73-75 octane:					
Oklahoma	6	6	6	6	6
Mid-Western (Group 3 basis)	6	6	6	6	6
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	6	6	6	6	6
E. Tex. (Truck Tnsp.)	6	6	6	6	6
63-66 octane:					
Oklahoma	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
Mid-Western (Group 3 basis)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)	5.625 (1)
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)	5.625 (2)
E. Tex. (Truck Tnsp.)	....	....	....	....	....
60 octane & below:					
Oklahoma	5.25	5.25	5.25	5.25	5.25
Mid-Western (Group 3 basis)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
N. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25	5.2 - 5.25
W. Tex. (For shpt. to Tex. & N. M. dest'ns.)	5.25	5.25	5.25	5.25	5.25
E. Tex. (Truck Tnsp.)	5.25	5.25	5.25	5.25	5.25
Motor Gasoline, 73-75 oct.					
New York harbor	8	8	8	8	8
New York harbor, barges	7.9	7.9	7.9	7.9	7.9
Philadelphia district	8	8	8	8	8
Baltimore district	7.75	7.75	7.75	7.75	7.75
Motor Gasoline, 70-72 oct.					
New York harbor	.....	....	....	....	....
New York harbor barges	.....	....	....	....	....
Philadelphia district	.....	....	....	....	....
Baltimore district	.....	....	....	....	....
Motor Gasoline:					
Western Penna. Bradford-Warren:					
(a) "Q" Gasoline, Min. 74 Oct. (ASTM)	7.50-7.75	7.50 - 7.75	7.50 - 7.75	7.50 - 7.75	7.50 - 7.75
Western Penna. Other Districts:					
"Q" Gasoline, Min. 74 Oct. (ASTM)	7 -7.25	7 - 7.25	7 - 7.25	7 - 7.25	7 - 7.25
70 oct. (ASTM)	....	....	....	....	....

Note: Gasoline prices are as reported in each day's Platt's OILGRAM. Daily Oil Price Service.

OIL PRICE SECTION ★ At Refineries and Terminals and by Tank Wagon

Prices herewith are reproduced from **Platt's** *OILGRAM* Daily Oil Price Service, associated with National Petroleum News, whose representatives in all *NPN-OILGRAM* offices devote their time exclusively to reporting oil industry prices everywhere.

Prices shown are actual sales prices, or quotations meaning sellers' general offers or posted prices; for current sales and shipment; for the business day or period stated; except Tank Wagon prices, prices are for bulk lots such as tank car and motor transport; barge or tanker cargo lot prices are identified; FOB refineries or terminals; in cents per gal. except where shown in bbls. of 42 gals.; ex all fees and taxes; for crude oil and its products lawfully produced and transported; reported as received by *OILGRAM* and National Petroleum News but not guaranteed; for subscribers' private use only and not for resale or distribution or publication. For further details of price conditions apply to any *NPN-OILGRAM* office or see back of any *OILGRAM* Price Service invoice.

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Refinery Prices

Gasoline —U. S. Motor (A S T M) except where otherwise specified.

Prices in Effect	Nov. 5	Oct. 29
OKLAHOMA		
78-80 oct. Ethyl	6.75	6.75
73-75 oct.	6	6
63-66 oct.	5.625 (1)	5.625 (1)
60 oct. & below	5.25	5.25
MID-WESTERN (Group 3 basis)		
78-80 oct. Ethyl	6.75	6.75
73-75 oct.	6	6
63-66 oct.	5.625 (2)	5.625 (2)
60 oct. & below	5.2 – 5.25	5.2 – 5.25
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl	7	7
73-75 oct.	6	6
63-66 oct.	5.625 (1)	5.625 (1)
60 oct. & below	5.2 – 5.25	5.2 – 5.25
W. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
78-80 oct. Ethyl	7 – 7.125	7 – 7.125
73-75 oct.	6	6
63-66 oct.	5.625 (2)	5.625 (2)
60 oct. & below	5.25	5.25
E. TEX. (Truck Tnspt.)		
78-80 oct.	7	7
73-75 oct.	6	6
63-66 oct.	....	....
60 oct. & below	5.25	5.25
CENT. W. TEX. (Prices to truck transports)		
78-80 oct.	7 (2)	7 (2)
73-75 oct.	6 (2)	6 (2)
67-69 oct.	....	....
60 oct. & below	5.25 (2)	5.25 (2)
KANSAS (For Kansas destinations only)		
78-80 oct. Ethyl	7.2 – 7.3	7.2 – 7.3
73-75 oct.	6.2 – 6.3	6.2 – 6.3
63-66 oct.	5.9 (2)	5.9 (2)
60 oct. & below	5.5	5.5
ARK. (For shipment to Ark. & La.)		
78-80 oct. Ethyl	7 (1)	7 (1)
73-75 oct.	6 (1)	6 (1)
62 oct.	....	....
60 oct. & below, unleaded	5.25 (1)	5.25 (1)
WESTERN PENNA. (Motor gasoline)		
Bradford-Warren:		
"Q" Gasoline Min. 74 Oct. (ASTM)	7.50-7.75	7.50 – 7.75
Other districts:		
"Q" Gasoline. Min. 74 oct. (ASTM)	7 –7.25	7 – 7.25
70 oct. (ASTM)	....	....
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis; for shpt. within Mich. may originate at plants outside Central group.)		
U.S. Motor: (Oct. ASTM):		
73-75 oct.	7.50 – 8.125	7.50 – 8.125
78-80 oct.	9-9.25 (2)	9-9.25 (2)
Str. run gasoline, excluding Detroit shpt.	5.75 – 6	5.75 – 6
OHIO (S. O. Ohio quotations for statewide delivery and subject to exceptions for local price disturbances).		
73-75 oct.	8.375	8.375
CALIFORNIA U.S. Motor:		
80-82 oct. (Ethyl)	8 – 8.5	8 – 8.5
74-75 oct.	7 – 7.5	7 – 7.5

Kerosine, & Gas Fuel Oils

Prices in Effect	Nov. 5	Oct. 29
OKLAHOMA		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5	4.5
Range Oil	4	4
No. 1 p.w.	3.875	3.875
No. 1 straw	3.75 (1)	3.75 (1)
No. 2 straw	3.625	3.625
No. 3 fuel	3.5	3.5
No. 6 fuel	$0.90–$0.97	$0.90–$0.97
U. G. I. Gas Oil	....	....
14-16 fuel	$0.97 (1)	$0.97 (1)
MID-WESTERN (Group 3 basis)		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5	4.5
Range Oil	4 –4.1	4 –4.1
No. 1 p.w.	3.875	3.875
No. 2 straw	3.625	3.625
No. 3	3.5(1)	3.5 (1)
No. 5	....	....
No. 6	$0.97 (1)	$0.97 (1)
N. TEX. (For shpt. to Tex. & N. M. dest'ns.)		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.5 (1)	4.5 (1)
No. 1 p.w.	3.875 (1)	3.875 (1)
No. 6 fuel	$0.97 (1)	$0.97 (1)
W. TEX.		
No. 6 fuel	$0.97 (1)	$0.97 (1)
E. TEX. (Truck Tnspt.)		
41-43 grav. w.w.	4.375	4.375
42-44 grav. w.w.	4.375–4.5 (2)	4.375–4.5 (2)
Range Oil	3.875–4 (2)	3.875– 4 (2)
No. 1 p.w.	3.875 (1)	3.875 (1)
45 Cet. Diesel	4.25 (1)	4.25 (1)
No. 2 straw	3.5–3.625 (2)	3.5–3.625 (2)
No. 3 fuel	....	....
58 D.I. & above	4.25 (1)	4.25 (1)
No. 6 fuel	$0.80–0.97	$0.80–0.97
U.G.I. gas oil	3.5 (1)	3.5 (1)
14-16 grav.	....	....
AMARILLO, TEX. (For shpt. to W. Okla. & Tex. differential territory.)		
42-44 grav. w.w.	4.5 (1)	4.5 (1)
KANSAS (For Kansas destinations only).		
41-43 grav. w.w.	No Price	No Price
42-44 grav. w.w.	4.7	4.7
No. 1 p.w.	4.1	4.1
No. 6 fuel	$1.02	$1.02
ARK. (For shipment to Ark. and La.)		
41-43 grav. w.w.	....	....
42-44 w.w. kero	4.5 (1)	4.5 (1)
No. 1	....	....
No. 2	3.625 (1)	3.625 (1)
No. 3 fuel	3.5 (1)	3.5 (1)
Tractor fuel, for shpt. to Ark. points only	5.125 (1)	5.125 (1)
Diesel fuel 52 & below	4 (1)	4 (1)
Diesel fuel 58 & above	4.25 (1)	4.25 (1)
WESTERN PENNA. *Bradford-Warren*:		
45 grav. w.w.	6.5 – 6.65	6.5 – 6.65
46 grav. w.w.	....	....
No. 1 fuel	6.5 (1)	6.5 (1)
No. 2 "	6.125	6.125
No. 3 "	6.25	6.25
36-40 gravity	6.25 (2)	6.25 (2)
Other districts:		
45 grav. w.w.	6.425	6.425
46 grav. w.w.	....	....
47 grav. w.w.	6.55 (2)	6.55 (2)
No. 1 fuel	6.175– 6.425	6.175– 6.425
No. 2 "	5.75 – 5.875	5.75 – 5.875
No. 3 "	5.75 – 5.875	5.75 – 5.875
36-40 grav. Pittsburgh dist. prices excluded	5.75 – 5.875	5.75 – 5.875
CENTRAL MICHIGAN (FOB Central Mich. refinery group basis for shpt. within Mich.; shpts. may originate at plants outside Central group.)		
46-49 gravity w.w.	5.8 – 6	5.8 – 6
P.W. Distillate	5.5	5.5
No. 3 gas. oil, Straw	5	5
U.G.I. gas oil	4.5	4.5
Fuel Oils (*Vis. at* 100).		
300-500 Vis	4.14	4.14
100-300 Vis.	4.25 – 4.5	4.25 – 4.5
OHIO (S. O. quotations for statewide delivery)		
Kerosine	7	7
CALIFORNIA		
40-43 grav. w.w.	7(1)	7(1)
San Joaquin Valley:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (1)	$1.20 (1)
Diesel fuel	4 (2)	4 (2)
Stove dist.	5 (2)	5 (2)
Los Angeles:		
Heavy fuel	$1.10 (2)	$1.10 (2)
Light fuel	$1.20 (1)	$1.20 (1)
Diesel fuel	3.25 – 4 (2)	3.25 – 4 (2)
Stove dist.	5 (1)	5 (1)
San Francisco:		
Heavy fuel	$1.15 (1)	$1.15 (1)
Light fuel	$1.25 (1)	$1.25 (1)
Diesel fuel	4.5 (1)	4.5 (1)
Stove dist.	5.5 (1)	5.5 (1)

NOTE: All above heavy fuels meet Pacific specification 400; light fuel, spec. 300; Diesel fuels, spec. 200; and stove distillate, spec. 100.

Lubricating Oils

Prices in Effect	Nov. 5	Oct. 29
WESTERN PENNA.		
Prices are for sales made, or offers reliably reported, to jobbers & compounders only.		
Viscous Neutrals— *No. 3 col Vis. at* 70°*F.*		
200 Vis. (180 at 100°) 420-425 fl.		
0 p.t.	38 (1)	38 (1)
10 p.t.	37 (1)	37 (1)
15 p.t.	36 (1)	36 (1)
25 p.t.	28–33	28–33
150 Vis. (143 at 100°) 400-405 fl.		
0 p.t.	36 (1)	36 (1)
10 p.t.	35 (1)	35 (1)
15 p.t.	34 (1)	34 (1)
25 p.t.	26–31	26–31

NOTE: Limited quantity neutrals available to regular trade.

Cylinder Stocks:

Brt. stk., 145-155 *vis. at* 210°, 540-550 fl., *No. 3 col.*		
10 p.t.	30.5 (1)	30.5 (1)
15 p.t.	29.5 (1)	29.5 (1)
25 p.t.	25	25
600 S.R. filterable	15	15
650 S.R.	15.5	15.5
600 fl.	16	16
630 fl.	17	17
MID-CONTINENT (F. o. b. Tulsa)		
Neutral Oils (*Vis. at* 100° *F. 0 to* 10 *P.P.*)		
Pale Oils:		
Vis. Color		
60-85—No. 2	7.5	7.5
86-110—No. 2	7.5	7.5
150—No. 3	11 –11.5	11 –11.5
180—No. 3	11.5 –15	11.5 –15
200—No. 3	12 –15	12 –15
250—No. 3	14 –16.5	14 –16.5
280—No. 3	15	15
300—No. 3	16 (2)	16(2)
Red Oils:		
180—No. 5	11.5 (1)	11.5 (1)
200—No. 5	12 (1)	12 (1)
280—No. 5	No Price	No Price
300—No. 5	16–17.5 (2)	16–17.5 (2)
Bright Stock—*Vis. at* 210°		
200 Vis. D	27 (1)	27 (1)
150-160 Vis. D:		
0 to 10 p.p.	23	23
10 to 25 p.p.	22.5–23	22.5–23
25 to 40 p.p.	23 (1)	23 (1)
150-160 Vis. E.	22 (1)	22 (1)
120 Vis. D:		
0 to 10 p.p.	22 (2)	22 (2)
600 S.R. Dark Green	8.5 (1)	8.5 (1)
600 S.R. Olive Green	10-11 (2)	10-11 (2)
631 S.R.	....	....
Black Oil	....	....
SOUTH TEXAS (Neutral Oils)		
Pale Oils (*Vis. at* 100°*F.*)		
Vis. Color		
100 No. 1½-2½	6.5	6.5
200 No. 2-3	8.75	8.75
300 No. 2-3	9.25	9.25
500 No. 2½-3½	10	10
750 No. 3-4	10.25	10.25
1200 No. 3-4	10.375	10.375
2000 No. 4	10.5	10.5

(Continued on next page)

NOTE—Parenthetical figures after prices indicate number of companies quoting when less than three companies are quoting.

NOTICE—Owing to great demand, refiners generally limit quotations to regular customers and refuse bids, though higher, from others. Refiners' prices and sales shown here reported in market trade.

Refinery Prices (Continued)

Prices in Effect	Nov. 5	Oct. 29
Red Oils:		
100 No. 5-6	6.5 (2)	6.5 (2)
200 No. 5-6	8.75	8.75
300 No. 5-6	9.25	9.25
500 No. 5-6	10	10
750 No. 5-6	10.25	10.25
1200 No. 5-6	10.375	10.375
2000 No. 5-6	10.5	10.5
CHICAGO (From Mid-Continent p.l. crude.) Neutral oils *vis. at* 100° *F.* 0 *to* 10 *p.p.*		
Pale Oils		
Vis. Color		
60-85—No. 2	9 (1)	9 (1)
86-110—No. 2	9.25 (1)	9.25 (1)
150—No. 3	12.5 (1)	12.5 (1)
180—No. 3	13 (1)	13 (1)
200—No. 3	13 (1)	13 (1)
250—No. 3	14 (1)	14 (1)
Red Oils:		
180—No. 5	13 (1)	13 (1)
200—No. 5	13 (1)	13 (1)
250—No. 5	14 (1)	14 (1)
280—No. 5	15 (1)	15 (1)
300—No. 5	15.5 (1)	15.5 (1)
Note: Viscous oils, 15 to 30 p.p. are quoted 0.5c lower; 60-85 and 86-110 No. 2 non-viscous oils, 15 to 30 p.p., 0.25c lower.		
Unfiltered Steam Refined (*Viscosity at* 210°)		
140	11.5 (1)	11.5 (1)
160	12.5 (1)	12.5 (1)
200	13.5 (1)	13.5 (1)
Bright stocks, 160 *vis. at* 210 *No.* 8 *color:*		
0 to 10 p.p.	24 (1)	24 (1)
15 to 25 p.p.	23.5 (1)	23.5 (1)
30 to 40 p.p.	21.5 (1)	21.5 (1)
E filtered Cyl. Stock	15.5 (1)	15.5 (1)
Note: To obtain prices delivered in Chicago add 0.25c per gal.		

Natural Gasoline

(Group 3 & Breckenridge prices are to blenders on freight basis shown below. Shipments may originate in any Mid-Continent manufacturing district.)

FOB GROUP 3		
Grade 26-70	4.5 (Quote)	4.5 (Quote)
FOB BRECKENRIDGE		
Grade 26-70	3.5 (Sale)	3.5 (Sale)
CALIFORNIA (FOB plants in Los Angeles basin)		
21 pound vapor pressure for blending	4.75(1)	4.75(1)

Naphtha and Solvent

(*FOB Group* 3)		
Stoddard solvent	6 625	6.625
Cleaners' naphtha	7.125	7.125
V.M.&P naphtha	7.1 - 7.125	7.1 - 7.125
Mineral spirits	6.1 - 6.125	6.1 - 6.125
Rubber solvent	7.1 - 7.125	7.1 - 7.125
Lacquer diluent	7.375- 8.125	7.375- 8.125
Benzol Diluent	7.875- 8.625	7.875- 8.625
WESTERN PENNA. *Other Districts:*		
Untreated naphtha	7-7.725 (2)	7-7.725 (2)
Stoddard solvent	7.25 -7.5	7.25 -7.5
OHIO (S. O. quotations for statewide delivery:) V.M.&P. naphtha, D.C. naphtha, Varnolene & Sohio solvent	10	10
Rubber solvent	9	9
E. TEXAS (Truck Tnspt.) Stoddard Solvent	7 (2)	7 (2)

Wax

WESTERN PENNA. (Bbls. C.L.) **White Crude Scale:**		
122-124 A.m.p.	4.25 (2)	4.25 (2)
124-126 A.m.p.	4 25	4.25
MID-CONTINENT (C.L. FOB Refinery) **Semi-refined:**		
128 AMP min., white, 50 kilo bags	No Price	No Price
132-134 AMP, bbls.	5.25 (1)	5.25 (1)
CHICAGO (FOB Chicago district refinery of one refiner, in bags, carloads. Carloads, slabs loose, 0.4c less. Melting points are EMP (ASTM) methods; add 3° to convert into AMP.) **Fully refined:**		
122-124 (bags only)	5.6	5.6
125-127	6	6
127-129	6.25	6.25
130-132	6.55	6.55
132-134	6.8	6.8
135-137	7.55	7.55

Petrolatums

WESTERN PENNA. (Bbls., carloads; tank cars, 0.5c per lb. less.)		
Snow White	6.125- 7.25	6.125- 7.25
Lily White	5.375- 6.25	5.375- 6.25
Cream White	4.375- 5.5	4.375- 5.5
Light Amber	3.375- 4	3.375- 4
Amber	3.125- 3.75	3.125- 3.75
Red	3 - 3.5	3 - 3.5

Tank Wagon Prices

Commercial or consumer tank car, tank wagon, dealer, and service station prices for gasoline do not include taxes; *they do, however, include inspection fees as shown in general footnote. Gasoline taxes, shown in separate column, include 1.5c federal, and state taxes; also city and county taxes as indicated in footnotes. Kerosine tank wagon prices also do not include taxes; kerosine taxes where levied are indicated in footnotes. Dealer discounts are shown in footnotes. These prices in effect Nov. 5, 1945 as posted by principal marketing companies at their headquarters offices, but subject to later correction.*

S. O. N. J.

Esso (*Regular Grade*)	Consumer Tank Wagon	Dealer T.W.	Gasoline Taxes	Kerosine T.W.
Atlantic City, N. J.	9.0	9.5	4.5	8.5
Newark	9.0	9.5	4.5	8.5
Annapolis, Md.	9.35	9.85	5.5	...
Baltimore	8.75	9.25	5.5	9.3
Cumberland	10.15	10.65	5.5	10.8
Washington, D. C.	9.0	9.5	4.5	9.8
Danville, Va	10.45	10.95	6.5	10.05
Petersburg	9.55	10.05	6.5	10.8
Norfolk	9.25	9.75	6.5	9.8
Richmond	9.55	10.05	6.5	10.8
Roanoke	10.75	11.25	6.5	10.3
Charleston, W. Va.	11.05	11.55	6.5	12.1
Parkersburg	10.35	10.85	6.5	11.8
Wheeling	10.35	10.85	6.5	12.4
Charlotte, N. C.	10.9	11.4	7.5	9.1
Hickory	11.45	11.95	7.5	10.1
Mt. Airy	11.3	11.8	7.5	9.3
Raleigh	10.65	11.15	7.5	10.1
Salisbury	10.95	11.45	7.5	10.5
Charleston, S. C.	9.75	10.25	7.5	....
Columbia	10.6	11.1	7.5	....
Spartanburg	11.3	11.8	7.5	....
New Orleans, La.	8.75	9.25	8.5	**10.0
Baton Rouge	8.75	9.25	8.5	**10.5
Alexandria	8.75	9.25	8.5	**10.5
Lake Charles	9.0	9.5	8.5	**12.0
Shreveport	8.5	9.0	8.5	**9.0
Knoxville, Tenn.	10.5	11.0	8.5	12.5
Memphis	8.9	9.4	8.5	10.5
Chattanooga	10.5	11.0	8.5	11.0
Nashville	10.5	11.0	8.5	10.0
Bristol	9.75	10.25	8.5	10.0
Little Rock, Ark.	9.5	10.0	8.0	10.0
New Iberia, La.	9	9.5	8.5	**8

	Mineral Spirits T.W.	V.M.&P. T.W.
Newark, N. J.	13	14.5
Baltimore, Md.	15.5	....
Washington, D. C.	15.5	....

Fuel Oils—T.W.	No. 1	No. 2	No. 3
Atlantic City, N. J.	8.5	7.5	9
Newark	8.5	7.5	9
Baltimore, Md.	8.3	7.5	9
Washington, D. C.	8.8	7.9	9.4
Norfolk, Va	8.5	7.3	8.8
Petersburg	8.8	7.5	...
Richmond	8.8	7.5	9
Charlotte, N. C.	9.1	8.9	...
Hickory	...	8.5	...
Raleigh	10.1	8.6	...
Charleston, S. C.	...	7.5	...
Columbia	...	8.5	...
Spartanburg	...	9.3	...

Effective Sept. 1, 1945, in the States of New Jersey, Delaware, Maryland, District of Columbia and Virginia, prices for No. 1 and No. 2 Fuel Oil were reduced 1.5c per gallon, all methods of delivery, as authorized by the Office of Price Administration. On the same date prices for No. 1 and No. 2 Fuel were reduced 1.20c per gallon in North and South Carolina.

*Effective Aug. 5, '42 minimum retail resale price of 14.2c posted thru New Jersey.

Discounts:

**Includes 1.0c per gallon State Tax.

*Effective Nov. 7, 1944, the discount for kerosine in the State of Virginia was eliminated, the discount in Tennessee was eliminated May 1, 1945 and the discount in Louisiana was eliminated May 7, 1945.

Undivided Dealers at Dealer Tank Wagon price less 0.5c per gallon for Esso Gasoline.

Esso gasoline—to undivided dealers, 0.5c off dealer t.w.

Kerosine—1c off t.w. price for 25 gals. or more, under contract thru territory (Baltimore city contract not necessary) except no discount in state of New Jersey, Virginia, Tennessee and Louisiana.

Naphtha—To buyers taking following quantities at one time: Newark, 2c per gal. on 200 gals. or more, less than 200 gals. 0.5c higher price; Baltimore, 2c off on 25 to 100 gals. and 3c on over 100 gals.; Washington, 2c off to contract buyers.

Effective September 1, 1945, in the States of New Jersey, Delaware, Maryland, and the District of Columbia, the price of all motor fuel and kerosene was reduced 1.20c and 1.50c per gallon, respectively, as authorized by the Office of Price Administration. At the same time motor fuel prices were reduced 0.60c per gallon and kerosene prices were reduced 1.0c per gallon in West Virginia and motor fuel and kerosene prices were reduced 0.80c and 1.20c per gallon, respectively, in North and South Carolina.

Notice

These prices include inspection fees on both gasoline and kerosine unless otherwise specified per gallon as follows:

Ala. 1/40c on gasoline; Ark. 1/20c; Fl. 1/8c; Ill. 3/100c; Ind. 1/5c in lots of 25 bbls. or less, 2/25c in lots of more than 25 bbls.; Kans. 1/50c; La. 1/32c; Minn. 7/200c; Miss. 1/50c; Neb. 3/100c; Nev. 1/20c; N. C. 1/4c; N. Da. 1/20c; Okla. 2/25c; S. Car. 1/8c; S. Da. 1/20c; Tenn. 2/5c; and Wisc. 3/100c.

Kerosine inspection fees only: Ala. 1/2c; Fla. 1/8c; Iowa 3/50c; Mich. 1/5c per gal.

CONT'L OIL

	Conoco **N-tane †Tank	Demand (*3rd Grade*) Wagon	Gasoline Taxes	Kerosine T.W.
Denver, Col.	10	9	5.5	10
Grand Junc., Col.	12.5	11.5	5.5	12.5
Pueblo, Col.	9.5	8.5	5.5	9.5
Casper, Wyo.	11.5	10.5	5.5	12
Cheyenne, Wyo.	10	9	5.5	9
Billings, Mont.	12	11	6.5	12.5
Butte, Mont.	11.5	10.5	6.5	13.5
Great Falls, Mont.	12	11	6.5	12.5
Helena, Mont.	12	11	6.5	13
Salt Lake City, Utah	13.5	12.5	5.5	14.5
Twin Falls, Ida.	14.5	13.5	7.5	17
Albuquerque, N. M.	10.5	9.5	*7	9.5
Roswell, N. M.	10	9	*7	7
Santa Fe, N. M.	10.5	9.5	*7.5	10
Ft. Smith, Ark.	9	6.25	8	8
Texarkana, Ark.	9	7.5	*5.5	7
Muskogee, Okla.	7.75	6.75	9	8
Oklahoma City, Okla.	8	7	9	8
Tulsa, Okla.	8	7	9	8

*Taxes: In gasoline tax column are included these city taxes—Albuquerque, & Roswell, 0.5c, Santa Fe, 1c. Texas 4c state tax applies within city limits of Texarkana, Ark.

†To consumers & Dealers.

NOTE: Current selling price—where this is lower than maximum price it is because of local competition. It is the actual selling price and is subject to revision due to delays in receiving information from the field.

**New Housebrand product is known as N-tane

S. O. CAL.

Standard Gasoline (*Regular Grade*)
Flight Gasoline (*Third Grade*)

	Standard Posted Net Tank Truck	Standard Posted Retail	Flight Posted Net Tank Truck	Flight Posted Retail	Gasoline Taxes
San Francisco, Cal.	10	14	9	12	4.5
Los Angeles, Cal.	9.5	13.5	8.5	11.5	4.5
Fresno, Cal	11	15	10	13	4.5
Phoenix, Ariz.	12	16	10	13	6.5
Reno, Nev	12	16	11	14	5.5
Portland, Ore.	10.5	14.5	9.5	12.5	6.5
Seattle, Wash.	10.5	14.5	9.5	12.5	6.5
Spokane, Wash.	12.5	16.5	11.5	14.5	6.5
Tacoma, Wash.	10.5	14.5	9.5	12.5	6.5
Boise, Ida.	13.5	17.5	12.5	15.5	7.5

*Chevron Aviation 73

	Posted Net Tank Truck	Gasoline Taxes	Kerosine Tank Truck
San Francisco, Cal.	12.5	4.5	11.5
Los Angeles, Cal.	12	4.5	10
Fresno, Cal	13.5	4.5	12.5
Phoenix, Ariz.	14.5	6.5	12.5
Reno, Nev	14.5	5.5	13.5
Portland, Ore.	13	6.5	13.5
Seattle, Wash.	13	6.5	13.5
Spokane, Wash.	16	6.5	16.5
Tacoma, Wash.	13	6.5	13.5
Boise, Ida.	18	4.0	16.5

Resale and Commercial Gasoline: Tank car deliveries of Chevron Aviation 73, Standard's Supreme and Flight Gasoline .25c per gal. below posted net tank truck price. Tank car deliveries of Standard Gasoline .375c per gal. below posted net tank truck price. Pearl Oil (The Standard Kerosene) Tank car deliveries 3c below posted tank truck price.

*Formerly Standard Aviation 73.

TEXAS CO.

	Gasoline—Dealer T.W. Fire-Chief (Regular)	Indian (*3rd Grade*)	Gasoline Taxes
Dallas, Tex.	7.5	6.5	5.5
Ft. Worth, Tex.	7.5	6.5	5.5
Wichita Falls, Tex.	8.5	7.5	5.5
Amarillo, Tex.	8.5	7.5	5.5
Tyler, Tex.	8.5	7.5	5.5
El Paso, Tex.	11	10.5	5.5
San Angelo, Tex.	8.5	7.5	5.5
Waco, Tex.	8.5*	7*	5.5
Austin, Tex.	8.5	7.5	5.5
Houston, Tex.	8.5	7.5	5.5
San Antonio, Tex.	8.5	7.5	5.5
Port Arthur, Tex.	8.5	7.5	5.5

*Less 1c temporary allowance to all dealers

(Continued on next page)

Tank Wagon Prices—Continued

S. O. IND.

	Red Crown Blue Cons. T.W.	Red Crown (Regular Grade) Dealer Prices Red Crown	Blue Crown (Third Grade)	Gaso-line Taxes	Kero-sine T.W.
Chicago, Ill.	11 6	9 6	9 1	4.5	10.3
Decatur, Ill.	11 6	9 6	8.7	4.5	10
Joliet, Ill.	11 9	10 3	9 2	4.5	10.3
Peoria, Ill.	11 7	9 9	9.7	4 5	10.1
Indianapolis, Ind.	11 6	10 1	9.6	5.5	9.8
Evansville, Ind.	11 4	9.9	8 6	5.5	9.6
South Bend, Ind.	12	10 5	10	5 5	10.2
Detroit, Mich.	11.4	9 9	...	4.5	9.7
Grand Rapids, Mich.	11 4	9 9	...	4.5	9.6
Saginaw, Mich.	11 4	9 9	...	4 5	9.6
Green Bay, Wis.	12 2	10.7	10 2	5.5	10.6
Milwaukee, Wis.	12 1	10.6	10 1	5.5	10.5
La Crosse, Wis.	11 9	10 4	9.9	5.5	10.3
Minneapolis - St. Paul	11 9	10 4	9.9	5.5	10.3
Duluth, Minn.	12 2	10 7	...	5.5	10.6
Mankato, Minn.	11 9	10.4	9.9	5.5	10.3
Des Moines, Ia.	11.4	9.9	9.4	5 5	*9.8
Mason City, Ia.	11 7	10.2	9 7	5.5	*10.1
St. Louis, Mo.	11 0	9 5	9 3	*4.5	9.8
Kansas City, Mo.	11 0	9 5	8 6	*4.5	9.4
St. Joseph, Mo.	11 2	9 7	9 2	*4 5	9.6
Fargo, N. D.	12 9	11 4	10.9	5 5	11.3
Huron, S. D.	12 3	10.8	10 3	5.5	10.7
Wichita, Kans.	10 3	8.8	7.2	4 5	8.7
Omaha, Neb.	11 4	9 6	9.4	6 5	9.8

	Oleum Spirits	V.M.&P. Naphtha	Stani-sol	*Taxes
(Prices are base prices before discounts)				
Chicago	13.5	13 8	12 8	4.5
Detroit	15 9	15	16.3	4 5
K. C., Mo.	13 3	14 3	13 8	1 5
St. Louis, Mo.	13 7	14 7	13 2	1.5
Milwaukee	14 4	15 4	14 9	5 5
Minneap'lis	14 2	15 2	13 5	5 5

Fuel Oils T.W.

Chicago	Standard Heater Oil	Stanolex Furnace Oil
1-99 gals.	9 0	8.5
100-149 gals.	8 0	7.5
150 gals. & over	7.5	...
150-399 gals.	...	7.5
400 gals. & over	...	7.0

	Stanolex Fuel A	Stanolex Fuel C
1-749 gals.	6.2	5.7
750 gals. & over	5.45	4.95

Stanolex Furnace Oil

Other Points	1-99 gals.	100 gals. X over
Indianapolis	8.7	7.7
Detroit	8 4	7.4
Milwaukee	8.7	7.7
Minneapolis	8.8	7.8
St. Louis	8.1	7 1
Kansas City	7.8	6.8

*Taxes: In gasoline tax column are included these city taxes—Kansas City, St. Joseph and St. Louis, 1c. Iowa kerosine prices are ex 4c state tax. In naphtha tax column are included 1.5c federal tax and state taxes.

State sales, occupation, consumer and use taxes to be added when applicable.

S. O. OHIO

	*Sohio X-70 Gasoline (Regular Grade) Con-sumer T.W.	**Re-sel-lers	‡S.S.	Gaso-line Taxes	†Kero-sine T.W.
Ohio, Statewide	12	10	13.5	5.5	9.0
Akron	12	9.5	12.5	5.5	9.0
Canton	12	9.5	12.5	5.5	9.0
Cincinnati	12	9.5	12.5	5.5	9.0
Cleveland	12	9.5	12.5	5.5	9.0
Columbus	12	9.5	12.5	5.5	9.0
Dayton	12	9.5	12.5	5.5	9.0
Lima	12	9.5	12.5	5.5	9.0
Mansfield	12	9.5	12.5	5.5	9.0
Marion	12	9.0	12 0	5.5	9.0
Portsmouth	12	9 5	12.5	5.5	9.0
Toledo	12	9 5	12 5	5 5	9.0
Youngstown	12	9.5	12 5	5.5	9 0
Zanesville	12	9.5	12 5	5.5	9.0

Aviation Gasoline—Statewide

	Consumer T.W.	Gasoline Taxes
Sohio Aviation Gasoline clear Spec. AN-F-22	14.5	5 5
Esso Ethyl Aviation 73 Oct.	15.5	5.5
Esso Ethyl Aviation 80 Oct.	16.5	5 5
Esso Ethyl Aviation 91 Oct.	17.5	5 5
Esso Ethyl Aviation 100 Oct.	24 5	5 5

	Naphtha—T.W. Statewide	Lucas County
S. R. Solvent	13.5	13.5
D. C. Naphtha	14.5	14.25
V.M.&P. Naphtha	14.5	14.25
Varnolene	14.5	14.25
Sohio Solvent	14.5	14.25

Fuel Oils—T.W.	No. 1	No. 2	No. 3	No. 4
Ohio, Statewide	8.0	8.0	7.5	*7.25

*Renown (third-grade) prices are same as X-70 unless otherwise noted.

**Except authorized agents.

‡Prices at company-operated stations.

††Statewide prices are subject to exceptions other than those shown.

Discounts:

Esso aviation—on contract to hangar operators and resellers. 2c off consumer t.w.

*For Cleveland area only. Full compartment hose dumps.

Fuel oils—Statewide prices are for t.w. & drum deliveries of 50 gals. or more; prices for deliveries of less than 50 gals are 0.5c higher

Naphthas—to contract consumers off t.w. prices—Statewide: 300 to 999 gals., 0.5c; 1000 to 2499 gals., 0.75c; 2500 to 4999 gals., 1c; 5000 or more gals., 1.5c. Lucas County: Less than 50 gals., tank wagon price, 50 to 249 gals., 0.5c; 250 to 499 gals., 1c; 500 gals. or over, 1.5c.

ATLANTIC REFINING

Atlantic White Flash (Regular Grade)

	Commercial T.W.	Dealer T.W.	Gaso-line Taxes	Kero-sine T.W.
Philadelphia, Pa.	9	9.5	5.5	10.75
Pittsburgh	9.5	10	5.5	11.1
Allentown	9.5	10	5.5	11.1
Erie	9.5	10	5.5	11.1
Scranton	9.5	10	5.5	11.1
Altoona	9.5	10	5.5	11.1
Emporium	9.5	10	5.5	11.1
Indiana	9.5	10	5.5	11.1
Uniontown	9.5	10	5.5	11.1
Harrisburg	9.5	10	5.5	11.1
Williamsport	9.5	10	5.5	11.1
Dover, Del.	...	10	5.5	11.1
Wilmington, Del.	...	9.5	5.5	10.6
Boston, Mass.	...	9.7	4.5	....
Springfield, Mass.	...	10.6	4.5	....
Worcester, Mass.	...	10.3	4.5	....
Fall River, Mass.	...	9.8	4.5	....
Hartford, Conn.	...	10.4	4.5	....
New Haven, Conn	...	9.8	4.5	....
Providence, R. I.	...	9.8	4.5	....
Atlantic City, N. J.	...	9.5	4.5	8.5
Camden, N. J.	...	9.5	4.5	8.5
Trenton, N. J.	...	9.5	4.5	8.5
Annapolis, Md.	...	9.85	5.5	9.3
Baltimore, Md.	...	9.25	5.5	8.3
Hagerstown, Md.	...	10.35	5.5	8.8
Richmond, Va.	...	10.05	6.5	10.8
Wilmington, N. C.	...	10.35	7.5	10.4
Brunswick, Ga.	...	9.5	7.5	*9.6
Jacksonville, Fla.	...	9.5	8.5	10.6

	Mineral Spirits T.W.†	V.M.&P. T.W.†
Philadelphia, Pa.	11	12.5
Lancaster, Pa.	12	13.5
Pittsburgh, Pa.	12.5	13.5

FUEL OILS—T.W.

	1	2	3	5	6
Phila., Pa.	8.6	7.5	7.5	5.24	4.53
Allentown, Pa.	9.1	7.8	7.8	....	....
Wilmington, Del.	8.6	7.5	7.5	....	....
Springfield, Mass.	....	7.9	7.9	....	....
Worcester, Mass.	....	7.9	7.9	....	....
Hartford, Conn.	....	7.7	7.7	....	....

*Does not include 1c Georgia kerosine tax.

†Mineral Spirits prices also apply to Stoddard Solvent; V.M.&P. prices also apply to Light Cleaners Naphtha.

Discounts:

Gasoline—to undivided dealers, 0.5c off dealer t.w. except Georgia & Florida dealer t.w. and undivided dealer t.w. prices are same.

Kerosine—Thru Penna. & Delaware, 2c off t.w. price on t.w. deliveries of 25 gals. or more at one time.

S. O. KY.

Crown Gasoline (Regular)

	†Crown-Gaso-line	Gaso-line Taxes	Kero-sine T.W.
Covington, Ky.	9.5	6.5	9.3
Lexington, Ky.	10.5	6.5	9.3
Louisville, Ky.	10	6.5	8.8
Paducah, Ky.	10	6.5	8.8
Jackson, Miss.	10	7.5	*9.0
Vicksburg, Miss.	9.5	7.5	*8.5
Birmingham, Ala.	10	*8.5	9.0
Mobile, Ala.	9	*9.5	8.5
Montgomery, Ala.	10	*9.5	*10.0
Atlanta, Ga.	10.5	7.5	*10.6
Augusta, Ga.	10.5	7.5	*10.1
Macon, Ga.	10.5	7.5	*10.6
Savannah, Ga.	9.5	7.5	*9.6
Jacksonville, Fla.	9.5	8.5	8.6
Miami, Fla.	9.5	8.5	8.6
Pensacola, Fla.	9	*9.5	8.0
Tampa, Fla.	9.5	8.5	8.6

NOTICE

These prices include inspection fee on both gasoline and kerosine unless otherwise specified per gallon as follows: Ala. 1/40c on gasoline; Florida 1/8c.

Kerosine inspection fee only: Ala. 1/2c.

HUMBLE OIL

Humble Motor Fuel

	Thriftane Humble (Regular Grade) *Tank Wagon	Re-tail	Thriftane (Third Grade) *Tank Wagon	Re-tail	Gaso-line Taxes
Dallas, Tex.	*7.5	10.5	*6.5	8.5	5 5
Ft. Worth, Tex.	*7.5	10.5	*6.5	8.5	5.5
Houston, Tex.	8.5	12.5	7.5	10 5	5 5
San Ant., Tex.	8.5	12.5	7.5	10 5	5.5

*Consumer tankwagon prices 1c per gallon above dealer tankwagon prices on Humble Gasoline, and Thriftane.

	Kerosine *Tank Wagon	Retail
Dallas, Tex.	7	10
Ft. Worth, Tex.	7	11
Houston, Tex.	8	11
San Antonio, Tex.	7	10

*To all classes of dealers & consumers

Canada

PRICES OF IMPERIAL OIL, LTD.

Per Imperial Gallon, which is 1.2 U. S. Gallons

IMPERIAL OIL

3-Star Imperial Gasoline (Regular Grade)

	†Gasoline T.W.	*Gasoline Taxes	Kero-sine T.W.
Hamilton, Ont.	16.5	11	18
Toronto, Ont.	16.5	11	18
Brandon, Man.	20.5	10	22.5
Winnipeg, Man.	20 0	10	22
Regina, Sask.	17 5	11	19.5
Saskatoon, Sask.	20 3	11	22.3
Edmonton, Alta.	18.4	10	20.4
Calgary, Alta.	15.5	10	17.5
Vancouver, B. C.	15	10	24
Montreal, Que.	16.5	11	17.5
St. John, N. B.	16	13	19
Halifax, N. S.	16	13	19

*Includes 3c Federal, and Provincia taxes.

†To divided & undivided dealers.

SOCONY VACUUM

Socony Mobilgas (Regular Grade)

	Com. Cons. T.W.	Undiv. Dlr. T.W.	Gaso-line Taxes
New York City			
Manhattan & Bronx	8.9	9.4	*5.5
Kings & Queens	8.9	9.4	*5.5
Richmond	8.5	9.0	*5.5
Albany, N. Y.	8.7	9.2	5.5
Binghamton, N. Y.	9.8	10.3	5.5
Buffalo	9.0	9.5	5.5
Jamestown, N. Y.	9.2	9.7	5.5
Mt. Vernon, N. Y.	8.9	9.4	5.5
Plattsburg, N. Y.	9.8	10.3	5.5
Rochester, N. Y.	9.6	10.1	5.5
Syracuse, N. Y.	9.3	9.8	5.5
Bridgeport, Conn.	8.8	9.3	4.5
Danbury, Conn.	9.3	9.8	4.5
Hartford, Conn.	9.4	9.9	4.5
New Haven, Conn.	8.8	9.3	4.5
Bangor, Me.	9.5	10.0	5.5
Portland, Me.	9.1	9.6	5.5
Boston, Mass.	8.7	9.2	4.5
Concord, N. H.	10.2	10.7	5.5
Lancaster, N. H.	10.8	11.3	5.5
Manchester, N. H.	10.1	10.6	5.5
Providence, R. I.	8.8	9.3	4.5
Burlington, Vt.	9.7	10.2	5.5
Rutland, Vt.	9.8	10.3	5.5

(Continued on next page)

Seaboard Export Coastwise Prices

Atlantic Coast

(Prices are of refiners, FOB their refineries & their tanker terminals, & of tanker terminal operators FOB their terminals)—Prices in Effect November 5.

Pacific Export

In Ship's Bunkers, or deep tank lots:

Prices in Effect	Nov. 5	Oct. 29
Diesel Fuel, Pac. Spec. 200	$1.45	$1.45
Grade C fuel, Pac. Spec. 400	$1.10	$1.10

MOTOR GASOLINE

District	70-72 Oct. (ASTM)	73-75 Oct. (ASTM)	KEROSINE and/or NO. 1 FUEL
N. Y. Harb.	....	8	5.6
N. Y. Harb., barges	....	7.9	5.5
Albany	....	8.1	5.8
Philadelphia	....	8	5.7
Baltimore	....	7.75	5.7
Norfolk	7.375	7.5	5.6
Wilmington, N. C.	....	7.5	5.55
Charleston	7.375	7.5	5.7
Savannah	7.25	7.37 – 7.375	5.55
Jacksonville	7.25	7.37 – 7.375	5.55
Miami	7.245 (1)	7.37 – 7.375	5.55
Tampa	....	7.37 – 7.375	5.55
Pensacola	....	7	4.8 (1)
Mobile	....	6.87	4.75 (2)
New Orleans	....	6.25	4.125– 4.25
Portland	....	8.3	5.8
Boston	....	8.2	5.7
Providence	....	8.2	5.7

FUEL OILS

	No. 2	No. 3	No. 5	No. 6
New Haven	5.2	5.2	$1.63 –$1.73	$1.55
N. Y. Harbor	5.1	5.1	....	....
Albany	5.3	5.3	....	$1.75 (1)
Philadelphia	5.2	5.2	$1.76 (2)	$1.55
Baltimore	5.2	5.2 (2)	$1.63 (1)	$1.55
Norfolk	5.2	....	$1.595 (1)	$1.515
Charleston	5.2	....	....	....
Savannah	5.2 (2)	....	$1.53 (1)	$1.45 (2)
Jacksonville	4.75 (2)	....	....	$1.445 (1)
Miami	4.75	....	....	$1.43
Tampa	4.75 (2)	....	....	....
Pensacola	4.75	....	....	$1.32
Mobile	....	....	....	....
New Orleans	....	....	....	....
Portland	3.75 (2)	....	$1.05 (1)	$0.97
Boston	5.3	5.3 (1)	....	$1.60
Providence	5.3	5.3 (1)	$1.775 (2)	$1.595
	5.3	5.3 (1)	$1.70 (1)	$1.57

Tank Wagon Prices (Continued)

	Mineral Spirits T.W.	V.M.&P. T.W.
Buffalo, N. Y.	10.9	12.1
New York City	11	12
Rochester, N. Y.	11.8	13.1
Syracuse, N. Y.	12.2	....
Boston, Mass.	12	13
Bridgeport, Conn.	†16.3	†17.3
Hartford, Conn.	†16.3	†17.3
Providence, R. I.	13	14

	Kerosine Yard	Kerosine T.W.	Mobilfuel Diesel T.C.	Mobilfuel Diesel T.W.	Mobilheat Fuel Yard	Mobilheat Fuel T.W.
New York:						
Manhat'n & Bronx	6.0	8.8	....	7.8	5.6	7.5
Kings & Queens	6.0	8.8	....	7.8	5.6	7.5
Richmond	6.0	8.8	....	....	5.6	7.5
Albany	6.0	8.3	5.3	7.8	5.5	7.5
Binghamton	7.4	9.7	....	9.2	6.9	8.7
Buffalo	7.1	9.4	6.5	8.8	6.7	8.5
Jamestown	7.2	9.5	....	9.1	6.8	8.5
Mt. Vernon	6.1	8.8	....	7.9	5.7	7.5
Plattsburg	6.6	8.9	....	8.4	6.1	7.9
Rochester	7.2	9.5	6.4	8.7	6.4	8.2
Syracuse	7.0	9.3	6.3	8.6	6.3	8.1
Conn.:						
Bridgeport	6.3	8.8	....	8.0	5.8	7.5
Danbury	6.7	9.3	....	....	6.3	7.0
Hartford	6.5	9.0	....	8.0	5.9	7.7
New Haven	6.0	8.8	5.5	7.8	5.6	7.5
Maine:						
Bangor	6.4	8.8	5.9	8.2	5.9	7.6
Portland	6.0	8.7	5.3	7.8	5.5	7.5
Mass.:						
Boston	6.3	9.1	5.3	7.8	5.7	7.6
N. H.:						
Concord	6.9	9.2	....	9.0	6.7	8.5
Lancaster	8.0	10.3	....	10.0	7.7	9.5
Manchester	6.5	8.8	....	8.7	6.0	7.9
R. I.:						
Providence	6.3	8.8	5.3	7.8	6.7	7.6
Vermont:						
Burlington	6.6	8.9	6.0	8.3	6.0	7.7
Rutland	6.8	9.1	....	8.5	6.2	8.0

Effective Sept. 1, 1945.

*Does not include 1% city sales tax applicable to price of gasoline (ex tax).

†In steel barrels

Discounts: Diesel—On t.w. deliveries, 0.5c for at least 400 gals.; 1c for full tank truck.

EXPORT PRICES

Effective Nov. 5

	Mexican Gulf Ports U. S. Dollars per Bbl. Bunker C	Diesel
Tampico	$0.97	$1.65
Veracruz	0.97	....
Coatzacoalcos	0.97	1.65
	Pacific Coast	
Guaymas	$1.50	$3.22
Mazatlan	1.50	3.22
Acapulco	1.50	2.89
Manzanillo	1.50	2.89
Salina Cruz	1.50	2.89

	Bunker C Fuel Ships' bunkers (Ex Lighterage)	Diesel Oil Ships' bunkers (Ex Lighterage)	Diesel Oil Shore Plants	Gas House Gas Oil 28-34 Gravity
New Haven	$1.57	....	....	....
N. Y. Harbor	$1.55	$2.15	5.2	5.3 (2)
Albany	$1.75 (1)	$2.31 (1)	5.3 (1)	5.5 (1)
Philadelphia	$1.55	$2.15	....	....
Baltimore	$1.55	$2.15 (2)	5.2 (1)	....
Norfolk	$1.515	$2.15 (2)	5.2 (1)	....
Charleston	$1.45 (2)	$2.15 (2)	5.2 (1)	....
Savannah	$1.445 (1)	....	....	....
Jacksonville	$1.43	$1.99 (1)	....	....
Tampa	$1.32	....	....	....
New Orleans	$0.97	$1.65 (1)	4 (1)	....
Portland	$1.60	....	5.3 (1)	5.4 (1)
Boston	$1.595	$2.19 (1)	5.3 (2)	5.3–5.4 (2)
Providence	$1.57	$2.192 (2)	5.3 (1)	5.3–5.4 (2)

Gulf Coast

Prices in Effect Nov. 5

MOTOR GASOLINE	New Orleans & Lower Mississippi to Baton Rouge Tank Cars	New Orleans & Lower Mississippi to Baton Rouge Barges	Texas Gulf Coast South of New Orleans Tank Cars	Texas Gulf Coast South of New Orleans Barges	CARGOES Domestic & Export From all Gulf Ports
Leaded (oct. by ASTM)					
78-80 oct.	6.75	6.5	6.75	6.75	6.75
73-75 oct.	6 – 6.25	5.75	5.75–6.5(a)	5.75	5.75
70 oct.	....	....	....	....	5.625
80 oct. gasoline Research 2cc lead max.	....	....	....	....	6
Unleaded 70 oct.	....	....	....	....	5.625
67-68 oct.	....	....	....	....	....
65 oct.	....	....	....	....	5.25
60 oct.	....	....	....	....	5
KEROSINE & LIGHT FUELS					
41-43 w.w. kero	4.125– 4.25	4.125	4.125– 4.25	4.125	4.125
42-44 w.w. kero	....	....	4.125	4.125	4.125
No. 2 fuel oil	3.75	3.75	3.75 – 4	3.75	3.75
DIESEL & GAS OILS					
(In diesel index No.)					
No. 5 fuel oil	$1.05	....	$1.05	....	....
43-47 di	....	....	....	....	4
48-52 di	4	4	4	....	4
53-57 di	4.125	....	4.125	4.125	4.125
58 and above	4.25	....	4.25	....	4.25

(a) 5.75c for Dist. 1 and 6.25–6.50 for other districts.

NOTE: Above products in Truck Transports of 2,400 gal. and over ½c above Tank Car Prices.

Heavy Fuels & Bunker Oil (at all Gulf Ports) Heavy Diesels	In Cargoes	In Ship's Bunkers (Ex Lighterage)
Below 28 API Grav	....	$1.35
28 & above API Grav	....	$1.65
Bunker C Oil	$0.97	$0.97

Mid-Continent Lubes

(At Gulf; in packages, FAS.; in bulk, FOB terminals).

Prices in Effect Nov. 5

Bright Stock	Steel Drums	Bulk
D color, Vis at 210°		
200 vis	....	....
150 vis., 0-10 p.p.	32.65 (1&a)	24.8 (1)
100 vis., 0-10 p.p.	....	....
100 vis., 10-25 p.p.	....	....
Neutral—No. 3 color		
200 vis., 0-10 p.p.	....	....

(A) FAS at New Orleans

TANKER RATES

Approximate rates, cents per bbl.: Gulf-N. Atlantic, not east of New York

Heavy crude & fuel, 10-19.9 grav.	43.8
Light crude, 30 grav. or lighter	39
Gasoline	32.9
Kerosine	36
No. 2 fuel	38

Wax

(Melting points are AMP, 3° higher than EMP) Prices are FOB refinery and do not include bag: freight or export differentials).

Prices in Effect Nov. 5

Crude Scale	New Orleans Export	N. Y. Domestic	N. Y. Export
124-6 Yellow	4.25 (1)	....	4.25 (1)
122-4 White	....	4.25 (2)	4.25 (2)
124-6 White	4.25 (1)	4.25	4.25
Fully Refined:			
123-5	5.2 (1)	5.2 (2)	5.2 (1)
125-7	5.2 (1)	5.2 (2)	5.2 (2)
128-30	5.6 (1)	5.6	5.6 (1)
130-32	5.85 (1)	5.85 (2)	5.85 (1)
133-5	6.15 (1)	6.15	6.15 (2)
135-7	6.4 (1)	6.4 (1)	6.4 (1)

Naphtha

Prices in Effect Nov. 5

	V.M.&P. Naphtha	Mineral Spirits
New York Harbor	11 (2)	10
Philadelphia	11 (2)	10
Baltimore	10.5 (2)	9.5
Boston	11.5 (2)	10.5
Providence	11.5 (1)	10.5 (2)

REFINERY OPERATIONS

(American Petroleum Institute figures in thousands of barrels of 42 gal. each. Figures include reported totals plus estimate of unreported amounts and are therefore on a Bureau of Mines basis.)

Districts	Daily Average Crude Runs to Stills Week Ended		Gasoline Production at Refineries inc. Natural Blended Week Ended		Kerosine Production Week Ended		Gas Oil & Dist. Fuel Oil Production Week Ended		Residual Fuel Oil Production Week Ended		Total Stocks Kerosine Week Ended	
	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20
East Coast	762	761	1,969	1,933	205	250	824	927	1,703	1,794	5,392	5,204
Appalachian (Dist. 1)	102	98	310	310	55	55	69	68	77	77	428	415
Appalachian (Dist. 2)	58	27	189	75	11	4	47	22	93	61	22	21
Ind., Ill., Ky	803	758	2,972	2,615	298	237	727	699	1,038	993	2,615	2,517
Okla., Kans., Mo.	388	382	1,394	1,406	169	137	369	353	471	456	1,007	995
Inland Texas	234	228	963	964	95	91	118	112	448	404	284	299
Texas Gulf Coast	1,153	1,087	3,900	2,982	480	388	1,601	1,206	1,593	1,442	1,711	1,684
Louisiana Gulf Coast	325	303	751	817	214	249	582	491	361	277	1,150	1,381
No. La. & Arkansas	69	65	197	168	66	64	68	68	120	120	372	299
Rocky Mt. (Dist. 3)	13	12	38	34	6	6	10	10	31	30	20	20
Rocky Mt. (Dist. 4)	127	111	383	332	12	14	110	103	224	179	97	108
California	804	803	2,464	2,378	88	37	634	574	2,532	2,683	410	395
Total U. S.—B. of M. Basis	4,838	4,635	15,530	14,016	1,699	1,532	5,159	4,633	8,691	8,516	13,508	13,338
U. S.—B. of M. Basis, Oct. 28, 1944	4,692	4,696	14,186	14,594	1,587	1,455	4,702	4,979	9,025	8,938	14,349	14,501

Districts	Total Stocks Gas oil and Distillates Week Ended		Total Stocks Residual Fuel Oil Week Ended		Gasoline Stocks: *Military and Other** Week Ended		Gasoline Stocks: Civilian Grade Week Ended	
	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20	Oct. 27	Oct. 20
East Coast	14,911	15,218	6,653	7,116	5,374	5,002	9,615	10,092
Appalachian (Dist. 1)	556	561	210	213	788	998	1,411	1,320
Appalachian (Dist. 2)	121	112	198	192	152	160	490	416
Ind., Ill., Ky.	6,161	5,907	3,298	3,209	3,942	4,036	11,231	10,306
Okla., Kans., Mo.	2,777	2,748	1,119	1,105	1,358	1,386	5,565	5,236
Inland Texas	476	470	1,010	935	968	905	1,566	1,546
Texas Gulf Coast	5,593	5,158	5,757	5,184	6,159	5,766	6,934	6,415
Louisiana Gulf Coast	1,956	1,734	1,126	1,039	727	816	2,464	1,969
N. La. & Arkansas	469	552	350	328	109	90	1,514	1,260
Rocky Mt. (Dist. 3)	20	20	35	37	15	15	88	86
Rocky Mt. (Dist. 4)	445	440	709	670	397	399	955	933
California	9,987	9,955	25,478	25,780	6,744	6,648	5,769	5,385
Total U. S.—B. of M. Basis	43,472	42,875	45,943	45,808	26,733	26,221	47,602	44,964
U. S.—B. of M. Basis, Oct. 28, 1944	47,419	46,837	64,405	64,087	38,826	38,298	39,757	39,445

*Includes aviation and military grades, finished and unfinished, title to which remains in the name of the producing company; solvents, naphthas, blending stocks currently indeterminate as to ultimate use, 8,775,000 bbl. unfinished gasoline this week, compared with 12,492,000 bbl. a year ago.

**These figures do not include any gasoline on which title has already passed, or which the military forces may have in their own or leased storage.

Percent Daily Refining Capacity Reporting—East Coast 99.5; Appalachian (Dist. 1) 76.8, (Dist. 2) 81.2; Ind., Ill., Ky., 87.2; Okla., Kans., Mo., 78.3; Inland Texas, 59.8; Texas Gulf Coast, 89.3; Louisiana Gulf Coast, 96.8; No. Louisiana & Arkansas, 55.9; Rocky Mt. (Dist. 3) 17.1; (Dist. 4) 72.1; California, 86.5; Total—U. S.—B. of M. Basis Oct. 27, 1945 85.7; Total—B. of M. Basis Oct. 20, 1945 85.7.

U. S. Crude Oil Production

(American Petroleum Institute figures)

	WEEK ENDED Barrels (Daily Average) Oct. 27	Barrels (Daily Average) Oct. 20
Oklahoma	*367,500	*361,250
Kansas	*264,950	*273,950
Nebraska	*800	*800
Texas	1,711,700	1,701,700
Louisiana	353,000	356,000
Arkansas	75,250	75,000
Mississippi	52,450	52,000
Alabama	100	50
Florida	150	150
Illinois	211,650	209,350
Indiana	13,850	13,550
Eastern (Ill., Ind. & Ky. excluded	62,850	62,800
Kentucky	29,900	28,950
Michigan	44,250	42,100
Wyoming	101,900	102,400
Montana	20,300	20,300
Colorado	19,100	17,900
New Mexico	99,900	99,900
California	843,400	818,300
Total, U. S.	4,273,000	4,236,850

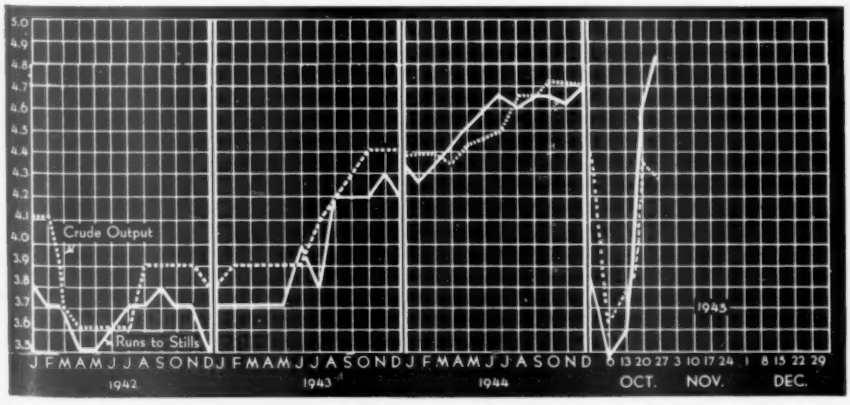
*Okla. Kans., Neb. figures are for week ended 7:00 A.M., Oct. 24, 1945.

Crude Oil Stocks

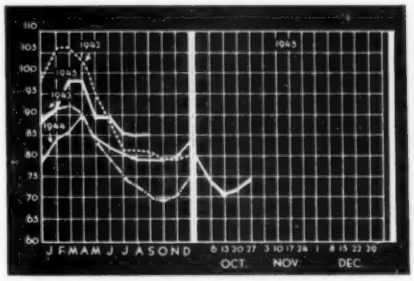
(Thousands of barrels)

Grade or origin	Oct. 20	Oct. 27	Change from Oct. 20
Penna. Grade	2,220	2,198	— 22
Other Appalachian	1,742	1,699	— 43
Lima-Michigan	952	962	+ 10
Illinois-Indiana	14,330	14,805	+475
Arkansas	2,514	2,364	—150
Kansas	9,594	9,574	— 20
Louisiana	13,148	13,942	+794
Northern	3,273	3,435	+162
Gulf Coast	9,875	10,507	+632
Mississippi	2,053	2,153	+100
New Mexico	6,353	6,373	+ 20
Oklahoma	34,641	33,978	—663
Texas:	111,446	109,493	—1,953
East Texas	20,102	19,125	—977
West Texas	32,940	33,283	+343
Gulf Texas	31,794	29,993	—1,801
Other Texas	26,610	27,092	+482
Panhandle	4,036	4,043	+ 7
North	6,580	6,782	+202
South	6,939	6,969	+ 30
Other	9,055	9,298	+243
Pocky Mountain	6,699	6,648	— 51
California	17,017	16,781	—236
Foreign	3,688	3,260	—428
Total gasoline-bearing in U. S.	226,397	224,230	—2,167
Heavy in California	4,570	4,540	— 30

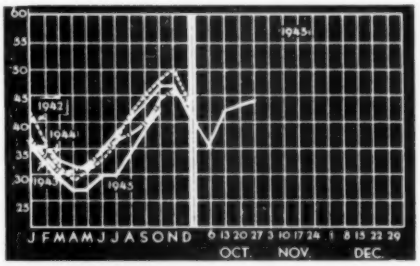
Crude Production & Runs to Stills *(Millions of Barrels)*


Crude Output
Runs to Stills
1945
J F M A M J J A S O N D J F M A M J J A S O N D J F M A M J J A S O N D 6 13 20 27 3 10 17 24 1 8 15 22 29
1942
1943
1944
OCT.
NOV.
DEC.

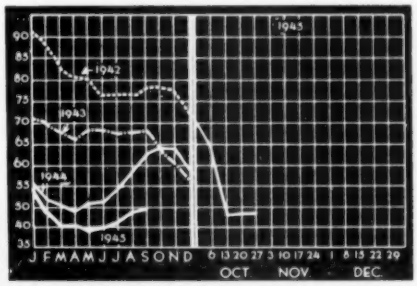
Gasoline Stocks *(Millions of Barrels)*



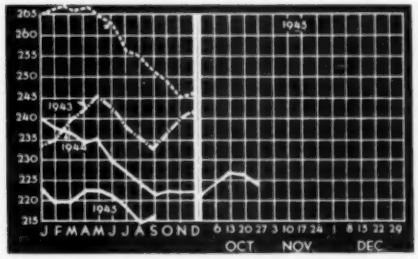
Gas Oil & Distillate Stocks *(Millions of Bbls.)*



Residual Fuel Oil Stocks *(Millions of Bbls.)*



Crude Oil Stocks *(Millions of Barrels)*



Pacific Coast Demand

(Bureau of Mines figures in thousands of bbls. daily)

	Gasoline		Gas Oil & Diesel		Heavy Fuel Oil		All Products	
	1944	1945	1944	1945	1944	1945	1944	1945
January	275	304	103	104	505	545	993	1,066
February	315	315	109	100	478	594	1,011	1,124
March	311	332	108	94	479	519	1,018	1,068
April	302	406	88	83	450	536	954	1,148
May	295	402	85	75	411	520	900	1,135
June	352	398	87	64	395	490	969	1,085
July	335	396	63	59	353	421	884	1,011
Aug.	329	370	63	78	349	434	883	1,010
Sept.	323		65		382		902	
Oct.	313		70		450		945	
Nov.	328		80		467		992	
Dec.	319		101		558		1,093	
Jan.-Aug.	314	364	88	82	427	504	951	1,076

Mid-Continent Lube Statistics (August 1945)

(Compiled by Western Petroleum Refiners Assn. from reports of member companies. Figures in bbls. of 42 gal.)

	Bright Stock	Viscous Neutrals	Paraffin Oils	Steam Refined Stock	Blended Oils
Production	257,522	323,495	56,064	19,811	367,501
Shipments:					
Domestic	269,548	348,022	60,129	22,984	357,533
Export	9,552	356	163	170	5,555
TOTAL	279,100	348,378	60,292	23,154	363,090
Inventory Aug. 31	141,226	166,796	59,058	40,450	119,792

Pennsylvania Lubricating Oils

(Compiled by National Petroleum Assn. from reports of companies refining Pennsylvania Grade crude oil. Figures in bbls.)

	Production Aug. 1945	Inventory Aug. 1945	Production July 1945	Inventory July 1945
Raw Long Residuum	51,272	36,704	48,131	52,920
600 Steam Refined Stock	236,500	83,744	257,073	115,453
Other Steam Refined Stock	55,849	44,923	28,318	31,073
Finished dewaxed Long Residuum	44,346	34,598	60,404	36,660
Bright Stock	190,801	174,744	153,248	137,478
Viscous Neutral (below 180 Vis.)	56,438	128,892	46,314	119,186
Viscous Neutral (180 Vis. at 100)	92,912	122,756	108,584	126,481

Production of Natural 'Gas,' Allied Products

	Aug. 1945	July 1945
East Coast		
W. New York		1
W. Pennsylvania	821	778
West Virginia	5,530	5,668
Ohio	337	348
Illinois	15,085	15,176
Kentucky	3,664	3,644
Michigan	1,203	1,205
Kansas	5,892	5,963
Oklahoma	35,011	34,159
Texas:	183,460	184,152
Gulf	44,884	46,068
East Texas	34,405	33,892
Panhandle	41,717	41,236
Other	62,454	62,956
Arkansas	7,026	7,272
Louisiana:	45,768	49,005
Gulf	27,810	27,497
Inland	17,958	21,508
New Mexico	9,319	9,203
Colorado	*	*
Montana	295	308
Wyoming	*4,224	*4,743
California	77,612	78,092
Total	395,247	399,717
Daily average	12,750	12,894
Total (thousands of bbls.)	9,411	9,517

* Wyoming includes Colorado drip gasoline.

Dealer and Service Station Gasoline Prices in 50 Representative U. S. Cities August, 1945

City	Dealers' Net Price (Ex. Tax)	Gasoline Tax (Inc. 1½ Cent Federal Tax)	Indicated Dealer Margin	Service Station (Inc. Tax)
Portland, Me.	10.80	5.50	4.0	20.30
Manchester, N. H.	11.80	5.50	4.1	21.40
Burlington, Vt.	11.40	5.50	4.0	20.90
Boston, Mass.	10.40	4.50	4.0	18.90
Providence, R. I.	10.50	4.50	4.2	19.20
Hartford, Conn.	11.10	4.50	4.0	19.60
Buffalo, N. Y.	10.10	5.50	4.2	19.80
New York, N. Y.	10.60	5.50	5.4	21.50
Newark, N. J.	10.20	4.50	5.0	19.70
Philadelphia, Pa.	10.20	5.50	4.2	19.90
Dover, Del.	10.70	5.50	4.3	20.50
Baltimore, Md.	9.95	5.50	4.05	19.50
Washington, D. C.	10.20	4.50	4.0	18.70
Charleston, W. Va.	11.65	6.50	4.05	22.20
Norfolk, Va.	10.45	6.50	5.55	22.50
Charlotte, N. C.	11.70	7.50	4.0	23.20
Charleston, S. C.	10.55	7.50	4.75	22.80
Atlanta, Ga.	11.10	7.50	4.0	22.60
Jacksonville, Fla.	10.10	8.50	4.0	22.60
Birmingham, Ala.	10.00	8.50	5.0	*23.50
Vicksburg, Miss.	9.50	7.50	5.0	22.00
Memphis, Tenn.	8.90	8.50	4.5	21.90
Lexington, Ky.	10.50	6.50	3.5	20.50
Youngstown, Ohio	9.50	5.50	3.0	18.00
South Bend, Ind.	10.50	5.50	4.5	20.50
Chicago, Ill.	9.60	4.50	2.76	16.86
Detroit, Mich.	9.90	4.50	3.74	18.14
Milwaukee, Wis.	10.60	5.50	4.3	20.40
Twin Cities, Minn.	10.40	5.50	4.5	20.40
Fargo, N. D.	11.40	5.50	4.0	20.90
Huron, S. D.	10.80	5.50	3.7	20.00
Omaha, Neb.	9.60	6.50	3.0	19.10
Des Moines, Ia.	9.90	5.50	3.5	18.90
St. Louis, Mo.	9.50	4.50	3.0	*17.00
Wichita, Kans.	8.80	4.50	3.2	16.50
Tulsa, Okla	8.00	9.00	3.0	20.00
Little Rock, Ark.	9.50	8.00	4.5	22.00
New Orleans, La.	8.75	8.50	4.75	22.00
Houston, Texas	8.50	5.50	4.5	18.50
Albuquerque, N. M.	10.50	7.00	4.5	†22.00
Denver, Colo.	10.00	5.50	4.0	19.50
Casper, Wyo.	11.50	5.50	5.0	22.00
Butte, Mont.	9.50	6.50	4.0	20.00
Boise, Ida.	13.50	7.50	4.0	25.00
Salt Lake City, Utah	13.50	5.50	4.5	23.50
Reno, Nev.	12.00	5.50	4.0	21.50
Phoenix, Ariz.	12.00	6.50	4.0	22.50
San Francisco, Calif.	10.00	4.50	4.0	18.50
Portland, Ore.	10.50	6.50	4.0	21.00
Spokane, Wash.	12.50	6.50	4.0	23.00

*Includes City Tax of 1.00; †Includes City Tax of 0.50.

Pennsylvania Oils Other Than Lubes At Refineries

(Compiled by National Petroleum Assn. from reports of oil region refiners. Figures in barrels.)

	Aug., 1945	July, 1945
Naphthas & Gasoline		
(1) Straight run, unblended and/or unleaded, for sale as motor fuel	2,953	2,347
(2) Naphtha and gasoline, for sale for blending or further refining, or held at refinery for further distillation, reforming blending or leading	232,272	236,916
(3) Below 65 Octane, not included in (1) or (2) above	1,227	1,248
(4) 65 Octane and above	165,983	192,715
Salable naphthas other than motor fuel material (does not include refinery process naphthas)	14,782	11,503
Kerosene	88,567	76,088
36/40 gas oil (include furnace oil)	55,552	48,297
Fuel oil (not reported above)	39,854	42,332
Oils held as cracking plant charging stocks	385,703	358,167
Non-viscous neutral	29,906	26,984
Wax distillate	91,594	85,936
Crude petrolatum	29,732	29,907
Wax (lbs.)	2,871,834	3,218,275

Net Stocks Of Pennsylvania Crude Oil

(Compiled by National Petroleum Assn. Figures in bbls.)

	Aug. 31 1945	July 31, 1945	Aug. 31, 1944
At Refineries	327,453	310,232	337,894
Pipeline and Tank Farm	1,472,998	1,425,236	1,527,877

CRUDE PRICES

Since changes in crude oil prices are few, the two pages of crude oil price tables are printed only when there are sufficient changes to warrant.

A record is kept in the Cleveland office of NPN and OILGRAM from which the publishers will be glad to make proofs, or letters or affidavits as to what the prices are, and without charge to regular subscribers.

Crude Price Changes

No price changes reported for week ending Oct. 31.

For latest table of crude prices published, see NPN Oct. 31, pages 75, 76 and 77.

Daily Av. Pennsylvania Crude Runs

(Compiled by National Petroleum Assn. from reports of all companies refining Pennsylvania crude. Figures in bbls.)

Week Ended Oct. 27, 1945	Week Ended Oct. 20, 1945	Week Ended Oct. 28, 1944
58,540	55,450	69,647

Skelly Oil Opens Marketing Institute for Ex-Veterans

Special to NPN

KANSAS CITY—Skelly Oil Co. has announced the opening of the Skelly Marketing Institute for the training of returned veterans and other new sales personnel and for refresher courses for present organization, including wholesale, retail and Skelgas division representatives who travel territories in 17 states.

"The course will be so thorough that it will require several weeks to complete," said the announcement, "and will comprise not only classroom studies, but laboratory field work as well. Special classrooms have been completely equipped with every facility for studying modern processes of petroleum product production, their quality and utility." Resident training will be held here where Skelly marketing headquarters are located.

Courses will place special emphasis upon present and future needs of motor car owners, and aims to further the Skelly policy of fitting all salesmen for better and more expert service to company jobbers and dealers. Not more than 12 salesmen will be received in each class, affording closer instructor-personnel contact and giving individual salesmen a better opportunity for advancement in training. The institute will operate continuously until the entire sales force has finished the courses and after that will be resumed at intervals as needed.

Activities of the "students" will cover research laboratories, refineries, tire factories and other sources of first-hand information in order to include every phase of petroleum product marketing, production and sales of tires, batteries and accessories, and other service station merchandise.

C.P.A. Is Self Liquidating

NPN News Bureau

CHICAGO—The Civilian Production Administration is a self-liquidating agency that will be in existence only as long as there is a need for it, John D. Small, Administrator, told the Reconversion Problems School of the Chicago Assn. of Commerce. Personnel of the WPB, which the C. P. A. succeeds, is not being disbanded but "streamlined" from a total of 11,500 persons just before V-J day to about 4,000, Mr. Small said.

GASOLINE CONSUMPTION BY STATES, JULY 1945

(American Petroleum Institute Figures)

	Tax Rate† July Cents	Month of June, 1945 Gallons	Month of July, 1945 Gallons	July, 1944 Gallons	Change %	7 Months Ending With July, 1945 Gallons	7 Months Ending With July, 1944 Gallons	Change %
Alabama	6	24,044,000	24,740,000	21,085,000	+17.33	165,861,000	148,081,000	+12.00
Arizona	5	10,388,000	10,021,000	9,836,000	+ 1.88	71,801,000	81,321,000	—11.71
Arkansas	6½	16,710,000	18,171,000	14,388,000	+26.29	113,445,000	100,861,000	+12.48
*California	3	226,949,000	238,983,000	212,850,000	+12.27	1,493,534,000	1,379,585,000	+ 8.26
Colorado	4	24,828,000	28,052,000	27,526,000	+ 1.91	168,577,000	173,929,000	— 3.08
Connecticut	3	26,915,000	26,024,000	23,002,000	+13.13	163,761,000	157,546,000	+ 3.94
Delaware	4	4,776,000	4,496,000	4,733,000	— 5.00	28,875,000	29,182,000	— 1.05
District of Columbia	3	10,192,000	9,120,000	8,941,000	+ 2.00	63,749,000	62,853,000	+ 1.43
Florida	7	32,890,000	32,474,000	30,644,000	+ 5.97	233,907,000	224,990,000	+ 3.96
Georgia	6	35,019,000	36,304,000	31,603,000	+14.87	233,474,000	215,317,000	+ 8.43
Idaho	6	9,637,000	10,165,000	8,639,000	+17.66	56,748,000	51,171,000	+10.90
Illinois	3	114,060,000	114,127,000	97,928,000	+16.54	702,543,000	684,373,000	+ 2.65
Indiana	4	71,811,000	70,818,000	61,237,000	+15.65	438,646,000	414,954,000	+ 5.71
Iowa	3	59,320,000	51,929,000	53,429,000	— 2.81	337,096,000	319,133,000	+ 5.63
Kansas	3	46,781,000	58,331,000	50,151,000	+16.31	274,876,000	258,247,000	+ 6.44
Kentucky	5	32,469,000	32,261,000	24,995,000	+29.07	210,209,000	165,038,000	+27.37
Louisiana	7	26,255,000	27,603,000	24,886,000	+10.92	185,958,000	174,570,000	+ 6.53
Maine	4	13,175,000	14,167,000	12,837,000	+10.36	78,615,000	73,166,000	+ 7.45
Maryland	4	28,227,000	25,993,000	23,584,000	+10.21	190,705,000	163,780,000	+16.44
Massachusetts	3	50,628,000	50,426,000	46,040,000	+ 9.53	324,700,000	303,985,000	+ 6.81
Michigan	3	101,789,000	100,500,000	94,974,000	+ 5.81	655,353,000	610,948,000	+ 7.27
Minnesota	4	46,900,000	48,165,000	43,556,000	+10.58	280,544,000	260,716,000	+ 7.61
Mississippi	6	19,571,000	21,236,000	16,703,000	+27.14	127,306,000	118,220,000	+ 7.68
Missouri	2	50,858,000	52,214,000	43,563,000	+19.85	312,259,000	301,464,000	+ 3.58
Montana	5	11,633,000	12,852,000	11,404,000	+12.70	71,018,000	65,866,000	+ 7.82
Nebraska	5	23,250,000	25,373,000	22,507,000	+12.73	144,727,000	133,571,000	+ 8.35
Nevada	4	5,206,000	4,557,000	5,296,000	—13.95	28,072,000	34,653,000	—18.99
New Hampshire	4	6,134,000	6,832,000	6,673,000	+ 2.38	39,025,000	36,862,000	+ 5.87
New Jersey	3	65,404,000	61,724,000	59 937,000	+ 2.98	413,266,000	397,607,000	+ 3.94
New Mexico	5	10,438,000	11,554,000	9,710,000	+18.99	69,650,000	63,595,000	+ 9.52
New York	4	128,051,000	128,923,000	123,784,000	+ 4.15	799,033,000	797,395,000	+ 0.20
North Carolina	6	38,795,000	39,461,000	33,047,000	+19.41	252,971,000	241,345,000	+ 4.82
North Dakota	4	16,587,000	17,455,000	16,262,000	+ 7.33	102,746,000	94,032,000	+ 9.27
Ohio	4	122,347,000	118,084,000	112,811,000	+ 4.67	800,349,000	794,071,000	+ 0.79
Oklahoma	7½	60,087,000	62,582,000	44,642,000	+46.91	352,571,000	255,186,000	+76.32
Oregon	5	24,147,000	25,247,000	24.693.000	+ 2.24	145,354,000	149,452,000	— 2.74
Pennsylvania	4	107,513,000	106,265,000	95,263,000	+11.54	672,358,000	651,088,000	+ 3.27
Rhode Island	3	10,936,000	10,292,000	11,505,000	—10.54	70,891,000	66,306,000	+ 6.91
South Carolina	6	17,696,000	18,825,000	16,607,000	+13.36	119,409,000	113,496,000	+ 5.20
South Dakota	4	12,684,000	14,900,000	13,249,000	+12.46	83,047,000	73,867,000	+12.42
Tennessee	7	31,502,000	33,285,000	26,047,000	+27.79	204,074,000	197,781,000	+ 3.18
Texas	4	399,437,000	401,857,000	354,844,000	+13.25	2,859,175,000	2,208,208,000	+29.47
Utah	4	10,125,000	10,842,000	9,276,000	+16.88	62,559,000	58,250,000	+ 7.39
Vermont	4	4,695,000	4,940,000	4,084,000	+20.96	27,380,000	24,630,000	+11.16
Virginia	5	37,295,000	36,856,000	36,167,000	+ 1.91	260,833,000	242,202,000	+ 7.69
Washington	5	34,966,000	35,493,000	31,621,000	+12.25	217,957,000	211,008,000	+ 3.29
West Virginia	5	15,421,000	16,516,000	11,959,000	+38.10	100,087,000	94,552,000	+ 5.85
†Wisconsin	4							
Wyoming	4	5.974.000	6,063,000	8,366,000		38.329.000	37,552,000	
Total		2,284,515,000	2,317,098,000	2,076,884,000		14,847,423,000	13,516,005,000	
Daily Average		76,151,000	74,745,000	66,996,000		70,035,000	63,455,000	
Change from previous year:								
Total Change			+240,214,000			+1,331,418,000		
Percentage change in Daily Average			+11.57%			+10.37%		

*These are State tax rates per gallon. In addition there is the Federal tax of One and one-half cents (1½c) per gallon.

†Not available at time of publication.

CLASSIFIED

For Sale

FOR SALE: North Minn. Jobbing Business. 1944 Sales approximately one-half million dollars, including nearly two million gals. light Refining products and T&B; $140,000. 20 year high earining record. Requires $50,000. No product change. State finances fully. Box 729.

ONE 3700 gallon, 3 compartment Columbian Transport Tank. Excellent condition. Air brakes or vacuum, will paint your color. $1200.00.
One 4000 gallon, three compartment Farrel Transport Tank. Excellent condition, vacuum brake or air. Will paint your color $1250.00. George C. Peterson Co., 2606 Elston Ave., Chicago, Ill.

FOR SALE

CD 40T Autocar Tractor, full air, 6 cylinder Cummings Diesel, installed gas pump, 1000 x 20 tires. Fully recoonditioned.

HAMILTON FINANCE CO.
131 State Street, Boston, Mass.
Telephone Hancock 2479

FOR SALE

One 1943, one 1944 Mack Truck Tractors also six 1943 and two 1944, 4000 gallon tank semi-trailers. All in first class condition. Write:

CENTRAL OIL COMPANY, INC.
P. O. Box 1034, Tampa 1, Florida

FOR SALE

1 1939 4000 gal. Fruehauff, 3 comp. air brakes
1 1944 4000 gal. Fruehauff, 3 comp. vacuum brakes
These trailers are very clean. A-1 condition.

KANEY TRANSPORT CO.
Freeport, Illinois

FOR SALE

1 Tank 2000 gallons
2 Tanks 6500 gallons
6 Tanks 15000 gallons
1 Tank 20000 gallons

EMPIRE EQUIPMENT CORPORATION
608 Empire Bldg., Cleveland 14, Ohio
Phone: Main 7667

FOR SALE

Six acres river front property on Ohio river located New Albany Indiana which is across river from Louisville. Ideal for barges and boats also served by Southern R.R. switch, several buildings available on property.

Chester B. Stem Inc.
New Albany, Indiana.

FOR SALE

1940 361 GMC Tractor, 1100 x 20 tires, air brakes
1939 20A White tractor 1000 x 20 tires, air brakes
300 gallon per minute new Granco pump and special power take-off
1938 Brockway, 1100 x 20 tires, vacuum brakes 2½" Yale Town Pump

These tractors are all in excellent condition, ready to start work. Will sacrifice for $2500.00 each.

WILLIAM A. EVANS
79 Fillmore Ave., Buffalo, New York

Wanted to Buy

WANTED: 1 No. 7 or No. 10 Sweetland Filter to remove contact clay. Give complete specifications, price and location. Box 731.

Positions Wanted

DISCHARGED VETERAN, desires position as lubricationn sales engineer, industrial and automotive. 15 years experience. Age 40, qualifications and training supplied on request. Box 723.

PHOTOGRAPHER-WRITER, 31, available only for particular, tough assignments. Acute, discreet and bold. Petroleum industry specialization. At home anywhere in U. S. A. Box 732.

NAVAL OFFICER interested in offer from refiner desiring distribution in Florida, and/or Georgia. 13 years experience in management of sales and distribution of major oil Co.'s petroleum products. 3½ years in Navy, duties in connection with determining requirements, procurement and shipment petroleum products. Also interested in purchase or distributorship requiring not more than $15,000 cash. Box 733.

YOUNG MAN, 34, youthful appearance, perfect health, expecting Army discharge about December 1. 13 years experience fuel sales, credit, correspondence, secretarial, rail and tidewater traffic looking for connection with progressive oil producing company or wholesaler. Capable taking full charge credit, traffic, sales or secretarial departments or as private secretary handling heavy detail work and correspondence for busy executive. Last position held 9 years. Box 721.

NAVAL LT. desires position in industrial sales with oil company in the east or midwest. Education: B.S. and M.S. in Chemical Engineering; four months Navy diesel school. Experience: Two years technical service with maior refinery; one year as engineering officer and one year as executive officer aboard LST; three months as Naval petroleum inspector; liaison officer for pipe line during petroleum plants seizure. Age, 28. Married. Available December 1, 1945. Box 724.

Situations Open

WANTED: Field representative for nationally advertised quality branded Pennsylvania motor oil sold through distributors, preferably experienced in this type operation. Write full details in confidence. Box 720.

FUEL OIL SALES

Long established large independent Chicago Oil Company needs exceptional man to direct retail fuel oil sales. A happy home with good pay awaits proper party with ability to promote more volume. State age and experiences.

Box 730

WANTED

Experienced sales engineer, production manager, assistant production manager and truck tank designer. Also purchasing agent familiar with the purchase of sheet steel and truck tank accessories. Write only giving detailed information regarding age, marital status, education and experience.

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ABOUT OIL PEOPLE

There has been a great deal of comment in recent years that major oil companies have done too little in getting their message over to the public. That may be a valid criticism, but undoubtedly there will be a little less of it when **William C. Daffron** comes into private petroleum business via Socony-Vacuum Oil Co., Inc.

Mr. Daffron

Mr. Daffron has been director of public relations of PAW Dist. 1 for more than a year. Born in Charlestown, W. Va., he was a newspaper correspondent and editor for 10 years and then spent two and half years in government service. He is known to all press correspondents as one of the most affable and most obliging men in government service.

According to Mr. Daffron, public relations work is no mysterious function to be cloaked in secrecy, but is a "vital part of all business, if it is to be successful." He said, before leaving PAW, that he believes public relations is simply a matter of advising management of "the little things that most executives are too busy to notice — to assist management in doing a really first-class job, and making certain that everyone, through the medium of good publicity, learns of the job well done."

♦ ♦ ♦

Paul Parker of Phillips Petroleum Co. legal department at Bartlesville is still in the hospital but doing nicely following an appendectomy recently.

Obituaries

The body of **William B. Milton**, well known Texas geologist, was found Sunday in a bayou near Houston after he had been missing from his home since Tuesday.

Mr. Milton received his Master's Degree in geology from the University of Texas and has lived in Houston since 1929. He was connected with the Houston Oil Co. as district geologist and was 1944-45 president of the Houston Geological Assn.

♦ ♦ ♦

Funeral services were held in Tulsa for Harry **Freundlich**, 56-year-old retired Dallas oil operator who died in a Houston hospital. Private services were conducted by Rabbi H. Barnston and Rabbi H. Schachtel at the Levy Funeral Home. Burial was in the mausoleum at Beth Israel Cemetery.

R. B. Hobson, general manager of the Houston Oil Co., has announced that **W. B. Duncan** has been appointed general superintendent in charge of drilling and oil and gas production, with headquarters in Houston. He replaces **C. L. Butchee**, who has resigned to enter the automobile business.

Mr. Duncan has been with the Houston company since March 1925, serving in various capacities in several locations in Hull-Daisetta, Camden, Arkansas, and Oklahoma as district superintendent; and in Shreveport as special agent. Mr. Butchee was employed by Houston Oil for the past 21 years, the last 13 years as general superintendent.

Other appointments announced by Mr. Hobson were: **R. E. Brewster**, scout in the Texas upper coast area, transferred to the land department in the Houston district; and **Capt. R. W. (Bill) Goff**, formerly in the warehouse department, just returned from active service with the Third Army, now scout in the Texas upper coast district.

♦ ♦ ♦

Mr. Jones

After two years with the Petroleum Administration for War, **E. O. Jones** has rejoined Ethyl Corp. and will be a staff assistant to **Julian J. Frey**, general sales manager. Mr. Jones, who had been with Ethyl for 12 years, was serving as acting assistant manager of the Safety Department when he joined PAW in October, 1943 as a petroleum engineer. He was later appointed special assistant to **A. P. Frame**, director of refining for PAW.

♦ ♦ ♦

C. H. Wagner, of Baltimore, Md., has been elected vice president and general manager of sales for American Oil Co., the Lord Baltimore Filling Stations, Inc., of Baltimore and Washington, and the Mexican Petroleum Corporation, Amoco President E. G. McKeever announced this week.

Joining Amoco as general manager in 1937, Mr. Wagner recently was made a member of the company's board of directors. He will assume his new executive duties November 1.

Besides directing marketing operations and sales of the more than 15,000 Amoco service station outlets from Maine to Florida, and of the Lord Baltimore Filling Stations, he will direct the activities of Mexican Petroleum Corp., manufacturers of asphalt-type oil products.

♦ ♦ ♦

Dr. H. B. Stenzel and **Mrs. Helen Jeanne Plummer**, geologists in the University of Texas bureau of Economic Geology, have been appointed to the Joint Committee on Zoological Nomenclature for Paleontology in America.

The University announcement said the Committee was organized by three national societies of paleontologists to aid American scientists in matters of classification and nomenclature of fossils, and to cooperate with the International Commission on Zoological Nomenclature.

♦ ♦ ♦

E. C. (Mack) McGurren, former assistant division sales manager for Skelly Oil Co. at Kansas City, took over as division manager at Chicago, effective Oct. 15.

♦ ♦ ♦

Mr. Markley

Don G. Markley has been appointed bulk sales manager for the central district of the Sinclair Refining Co., succeeding **Frank E. Sheehan**, who died June 15 of this year. Mr. Markley will supervise jobber and other bulk sales in the states of Illinois, Indiana, Michigan, Ohio and Wisconsin. He is located in the Chicago office.

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ABOUT OIL PEOPLE

Appointment of **Robert V. Kerley** as director of aeronautical research for Ethyl Corp., is announced by **Earl Bartholomew**, general manager of Ethyl Research Laboratories. Mr. Kerley succeeds **S. D. Herom**, who is retiring from active supervision of aeronautical research but who will remain with the company as a special consultant.

Mr. Kerley

Mr. Kerley was formerly a civilian engineer with the engineering division of the U. S. Army Air Forces at Wright Field, Dayton, and since 1936 has been chief of the fuel and oil branch, power plant laboratories of the Air Technical Service Command.

◆ ◆ ◆

Raymond R. Hooper, who until recently was assistant director of supply and transportation for PAW Dist. 1, has been appointed traffic manager of Cities Service Oil Co. (Pa.) From the time that he was employed in an oil company traffic department while attending evening high school, Mr. Hooper has specialized in this field.

Mr. Hooper has previously been associated with Sinclair Refining Co.'s traffic department and with the traffic department of Richfield Oil Corp. In 1941 he was appointed general manager for Marshall Service of Newfield, N. J., petroleum tank truckers. Shortly after Pearl Harbor, Mr. Hooper was called to Washington as consultant in the tank truck section of ODT, later assisting the American Trucking Assn. in Washington on problems relating to petroleum transportation. In 1942 he became traffic assistant to the transportation committee of the Petroleum Industries Committee, and for a time was assistant to the transportation manager before taking his duties as assistant director of supply and transportation of Dist. 1.

◆ ◆ ◆

Hoyt Carruth has been promoted to traffic manager of the refining department of Sunray Oil Corp., succeeding **J. B. Fairfield**, resigned. Mr. Carruth began his nine year service with Sunray at the Allen, Okla., refinery as yield and payroll clerk. In 1941 he was transferred to the refinery division of the accounting department in the general offices at Tulsa.

◆ ◆ ◆

Robert A. Eakin has joined the lease-records section of the land department of Sunray. Mr. Eakin was formerly assistant vice president of the Home Federal Savings and Loan Assn. of Tulsa.

Original suppliers operating in Zone 6 of District 1 of PAW will give a testimonial banquet at the Roosevelt Hotel, Pittsburgh, on Nov. 16 to honor PAW District 6 Zone Manager **William M. Horigan** and **Mark Stillwagon**, manager of Zone 6 P.I.C. and their associates, for "their splendid service and co-operation" during the war.

In addition to the guests of honor, **Charles L. Harding**, District 1 Director of PAW, and **John Harper**, District 1 Director of Distribution and Marketing, will attend.

M. F. Sloan, Jr., is secretary and treasurer for the committee arranging the banquet, which is composed of **J. R. Phillips**, Standard Oil Co. (Pa.), chairman; **F. G. Bannerot, Jr.**, Elk Refining Co.; **N. T. Brenner**, Gulf Oil Corp.; **V. F. Eva**, Frontier Oil Corp.; **F. C. Farley**, West Virginia Petroleum Assn.; **C. S. Felton**, L. Sonneborn Sons, Inc.; **C. P. Rennacker**, Quaker State Oil Rfg. Co.; and **R. D. Whitely**, Socony-Vacuum Oil Co.

◆ ◆ ◆

Henry J. Muller, general sales manager of the White Star Division, Socony-Vacuum Oil Co., Inc., Detroit, announces the appointment of **Harry Kuegler** as special sales assistant, effective Nov. 1. Mr. Kuegler comes to Socony-Vacuum with an impressive background of long experience in the petroleum industry. In 1909 he joined the Great Western Oil Co. in Cleveland.

Two years later Mr. Kuegler associated himself with the National Refining Co. and through advancement worked himself up to the position of manager of refinery sales of that company. He has been a member of the Lubrication Committee of the American Petroleum Institute since its inception. He is also a member of the Twenty-Five Year Club of the Petroleum Industry. Through his long association with petroleum, Mr. Kuegler has acquired a wide acquaintance throughout the industry.

◆ ◆ ◆

Charles J. Kay was recently appointed sales manager of the Norwalk Co. Mr. Kay served Sunset for many years as sales manager and more recently was manager of the Pathfinder Distributing Co.

◆ ◆ ◆

John A. Snyder, formerly with Champlin Refining Co. in the Denver area has joined Saunders Petroleum Co., Kansas City, and will open an office at Denver about Jan. 1, 1946, according to **Lee Saunders**. Mr. Snyder will handle sale of gasoline and other products in the Rocky Mountain area for Saunders Petroleum Co., including asphalt to be supplied by Frontier Refining Co.

E. I. Boldon, sales manager in the La Crosse, Wis., sales division of Standard Oil Co. (Indiana), has been promoted to assistant manager of the South Bend, Ind., sales division, succeeding **A. D. Oetjen**, recently appointed sales promoter-reseller in the Chicago general office. **R. G. McKinney**, special representative at La Crosse, succeeds Mr. Boldon.

COMING MEETINGS

NOVEMBER

American Petroleum Institute, Nov. 12 to 15. Hotel Stevens, Chicago.

Twenty-Five Year Club, Casino Club, Chicago, Nov. 13.

American Chemical Society, Chicago Section, Northwestern University, Evanston, Ill., Nov. 16.

South Dakota Independent Oil Men's Assn., Watertown, S. D., Nov. 26-27.

DECEMBER

Nebraska Petroleum Marketers' Assn., Hotel Paxton, **Omaha, Dec. 4, 5, 6.**

Arkansas Independent Oil Marketers Assn. annual convention, Albert Pike Hotel, Little Rock, Ark., Dec. 5.

Society of Automotive Engineers national air transport engineering meeting, Edgewater Beach Hotel, Chicago, Dec. 3-5.

Mid-Continent Oil & Gas Assn., annual federal tax forum and meeting of standing committee on federal taxation. Dec. 4-5.

Independent Natural Gas Assn., Dallas, Dec. 10.

Oil Dealers Assn. of Arkansas, Hotel Marion, Little Rock, Dec. 11.

Wisconsin Petroleum Marketers, Dec. 11-12.

Interstate Compact Commission, Wichita, Kans., Dec. 13-15.

Mid-Continent Oil & Gas Assn., annual board of directors meeting, Tulsa, Club Roof Room, Tulsa Building, Tulsa, Dec. 18 (tentative).

JANUARY

Oil & Heat Institute of America board of directors, Commodore Hotel, New York, Jan. 8, 1946.

Northwest Petroleum Assn., Jan. 24-25, Nicollet Hotel, Minneapolis, Minn.

FEBRUARY

Kentucky Petroleum Marketers Assn. 20th annual meeting and trade exhibit Brown Hotel, Louisville, Ky., Feb. 12-13.

Illinois Petroleum Marketers Assn. convention, Hotel Pere Marquette, Peoria, Ill., Feb. 12-14.

Iowa Independent Oil Jobbers Assn., Des Moines, Feb. 26-27.

APRIL

Natural Gasoline Assn. of America, annual convention, **Baker Hotel, Dallas, Texas,** April 17-18-19, 1946.

National Petroleum Assn., Hotel Cleveland, Cleveland, O., April 18-19, 1946.

Oil & Heat Institute of America Industry Exhibition, Philadelphia, April 23-27, 1946.

MAY

National Association of Corrosion Engineers, President Hotel, Kansas City, May 7, 8, and 9.

FOAM FOUGHT KAMIKAZES

—and Won!

Jap Kamikaze diving on carrier. How foam blanket quickly extinguishes serious fires aboard ship. Arrows point to cans of easily applied "bean soup"

Official U. S. Navy Photo

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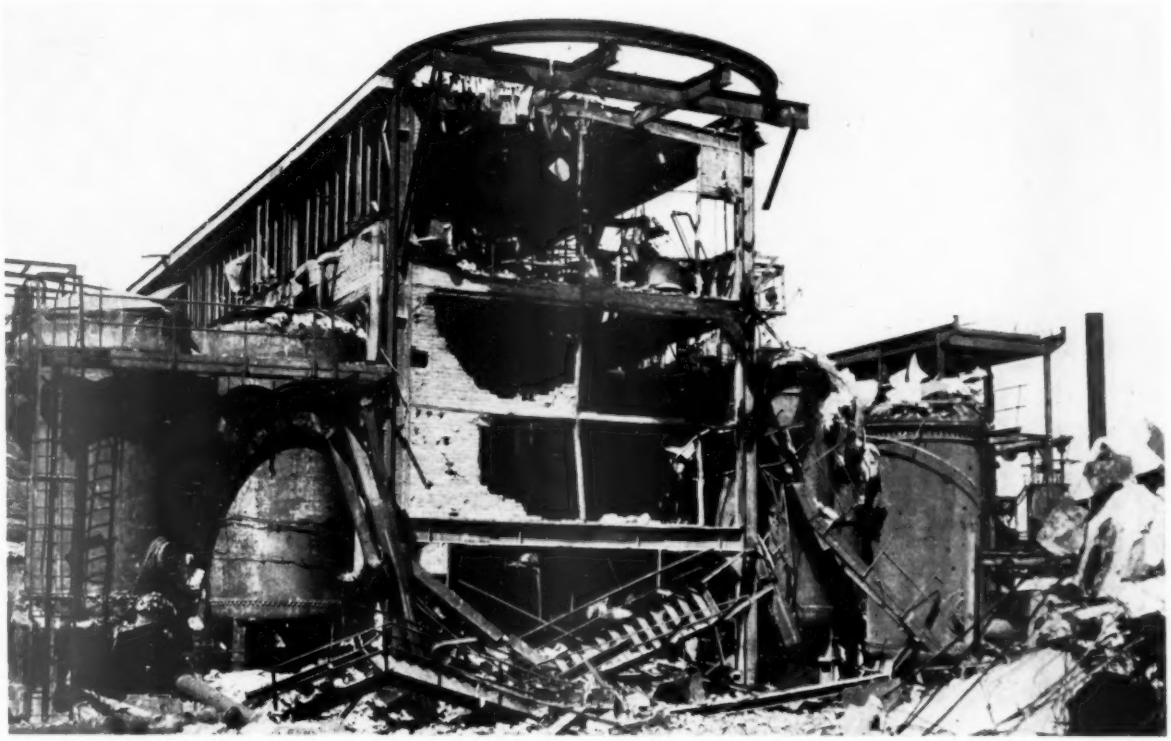
NATIONAL PETROLEUM NEWS

Monthly Technical Section Devoted to
REFINERY MANAGEMENT and PETROLEUM CHEMICAL TECHNOLOGY

Section Two | November 7, 1945 | Vol. 37, No. 45



Converter house and reaction vessels of a German Fischer-Tropsch plant at Hoesch Benzine after allied bombing. The 3-story converter house is described as "the heart of the Fischer-Tropsch plant"; it contains the catalyst cases in which the synthesis gases are converted to heavier hydrocarbons

GERMANY'S WARTIME OIL PROCESSING DISCLOSED

The special articles listed below, all appearing in this issue of the NPN TECHNICAL SECTION, have been prepared from the first official reports of the U. S. Oil Mission to Germany released from Army secrecy restrictions

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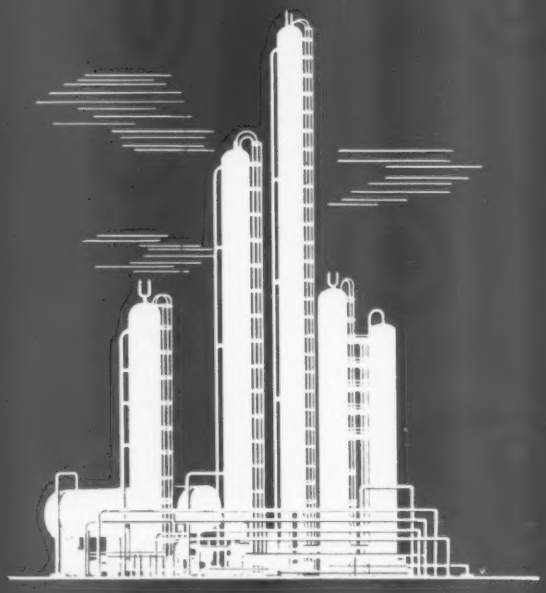

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Biggest "SCOOP" in All-Time Reporting of Refining News!

The special articles in this issue reviewing the first reports of the U. S. Technical Oil Mission to Germany to be released from Army secrecy restrictions give the oil industry its first detailed information on scientific developments in Germany during the war. They are the first comprehensive articles on this subject to appear to this date not only in any oil publication but also in any general scientific journal, as far as is known.

In preparing the articles NPN Technical Section's Editorial Staff, in Washington, reviewed the individual reports as they were "declassified" by the Army. Adding to the difficulties of the reporting task was the fact that only one copy of some of the reports was available at the time. Petroleum technologists on the U. S. oil teams were also interviewed for supplementary data in preparing the articles.

Many more reports of the Oil Mission are yet to be "declassified" and these will be reviewed in NPN's Technical Section as they become available. On pg. R-930 of this issue will be found a listing of the more important reports for oil men which so far are available, together with information as to how the complete reports may be secured.

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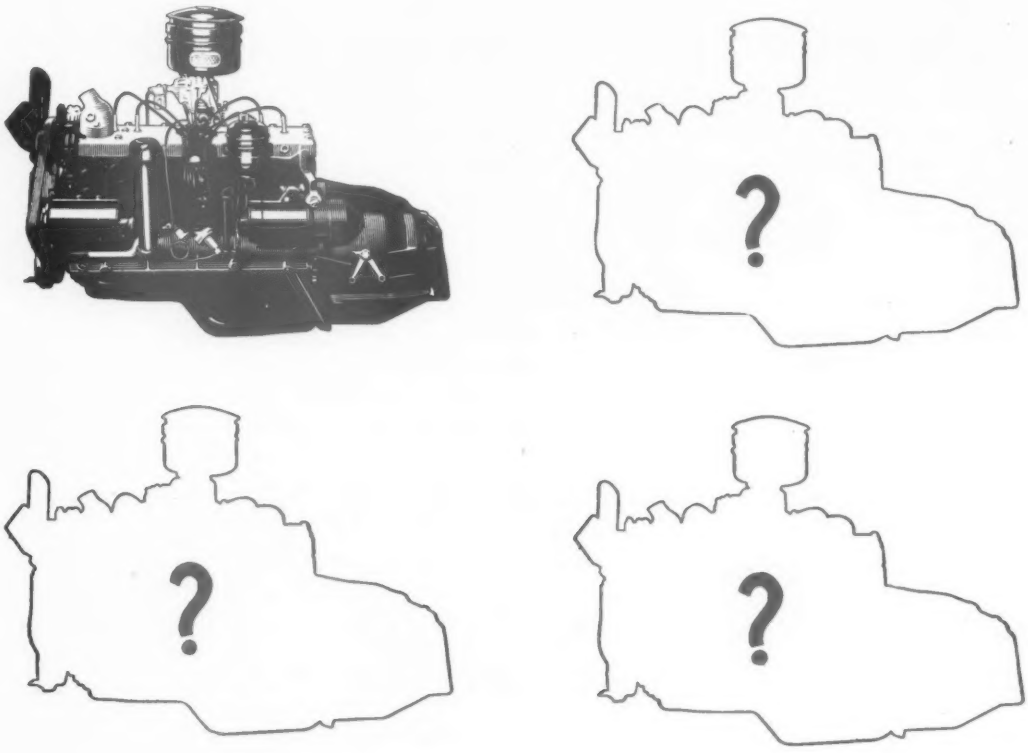

HOW MANY ENGINES ARE THERE IN YOUR LIFE?

LET'S SEE—there's the engine in your car. That's one. But don't answer the question too quickly; you may be overlooking dozens of other important engines.

For example, when you came down to breakfast this morning you found a bottle of milk that had just been delivered in a milk "wagon" hauled by an engine instead of a horse. Your rolls, eggs and coffee, too, came at least part way by truck. And the breakfast food you ate was probably grown with the aid of a gasoline-engined tractor.

There's a good chance you came to work on a bus. That's another big engine to remember. The airmail letter waiting for you on your desk got there with the help of two—maybe four—powerful aviation engines. And sometime during the day a motor truck will roll up to your door with materials for you, while perhaps another one is delivering your products to your customers.

We could go on and on—but by now you've realized there is scarcely a thing you eat, drink, read, wash yourself with, make, buy or sell that isn't manufactured or transported with the help of gasoline engines. In fact, your life is full of engines. Doesn't it follow that when these engines are made more efficient, more powerful, more economical, more durable, you will benefit?

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REFINERY MANAGEMENT *and* PETROLEUM CHEMICAL TECHNOLOGY

Nov. 7, 1945
Volume 37
Number 45

MONTHLY TECHNICAL SECTION OF NATIONAL PETROLEUM NEWS *incorporating International Petroleum Technology*

Wartime Refining in Germany

Germans Made High Aromatic Aviation Gasoline by Coal Hydrogenation

By Warren F. Faragher, Houdry Process Corp.
Member, U. S. Technical Oil Mission to Germany

The coal hydrogenation plants in Germany were recognized early in the war as the potential source of a considerable part of the aviation gasoline supply for the Luftwaffe. Development work was chiefly in the direction of finding means to increase the aromatic content as well as octane number of the finished product.

To this end variations in operations were adopted, including the use of higher pressures. More particularly, what was known as the D.H.D. process was developed; this was a dehydrogenation process for converting the naphthas and low quality gasoline from direct coal hydrogenation into a product of high aromatic content. This product was blended back with other light gasolines to give a finished gasoline with an aromatic content of 40-45% and an octane number of around 90 leaded.

While the total yield of aviation gasoline was reduced about a fifth by this means, the hydrocarbon gases from the D.H.D. and similar processes were used for producing alkylates and other aviation gasoline blending agents. The methods by which the Germans produced isooctane are also described.

The report published below on German wartime developments in hydrogenation, including aviation gasoline manufacture, is a portion of a Technical Industrial Intelligence Committee report, "Investigations by Fuels and Lubricants Teams at the I. G. Farbenindustrie A. G. Works at Ludwigshafen and Oppau" (Index No. 101). Author of this section of the report was W. F. Faragher, Houdry Process Corp., a member of the U. S. Technical Oil Mission to Germany.

A—Bituminous Coal Hydrogenation

THE plant at Sholven, put into operation in 1936, employs a pressure of 300 atm. for the coal liquefaction stage. Acid catalyst conditions are employed, i.e., tin oxalate catalyst (0.06% on coal) is added to the feed paste and ammonium chloride (0.7-1% on the coal) is injected to the first converter. Corrosion is avoided by the injection of sodium carbonate at the end of the last converter.

The number of coal stalls at Sholven has been increased to six during the war and the capacity of the plant brought up to 200,000 tons a year finished product, mainly aviation base gasoline.

Because of the difficulty in obtaining tin oxalate, other tin compounds and occasionally lead salts have been substituted. The latter were found to give higher yields of "unconverted" coal. Apart from minor changes of this type, there has been no modification of the process and no marked improvement in efficiency of the process during the war. The yield of aviation gasoline is just over 50% of the a.m.f. coal.

The new bituminous coal hydrogenation plants, namely Gelsenberg, Stettin and Blechhammer, employ a pressure of 700 atm. in the liquid phase stalls. Alkaline catalyst conditions are employed. 1.2-1.7% of iron sulphate (including water of crystallization) is added to the coal before drying; 1.5-2.5% of Bayermasse (an iron-rich residue from aluminum manufacture) is then added and finally, at the pasting stage, 3% of sodium sulphide is introduced. The above quantities are % by weight on the dried coal treated.

It should be noted that acid reaction conditions cannot be used at 700 atm. because the iron/HCl/H_2S equilibrium is such that corrosion occurs in the converter and hot catchpot. At 300 atm. corrosion does not occur above about 350° C. and addition of alkali before the products are cooled in the interchanger is sufficient to avoid corrosion trouble.

The use of the higher pressure permits the use of a higher average reaction temperature than with the 300 atm. process. As a result of the increased temperature and pressure, the throughput of coal for a given reaction volume is some 60% greater in these new plants than at Sholven. On the other hand, standard 700 atm. converters have only 75% of the reaction volume of those operating at 300 atm., so that the throughput of coal per converter is only some 20% higher at the higher pressure.

From the standpoint of yield, the main advantage of the 700 atm. operation is a reduction in the amount of "unconverted" coal residue. This is usually 3-4% on the ash and moisture-free coal at 700 atm. operation, compared with 7-8% for 300 atm. operation. This has the secondary effect that, since less solid material has to be purged from the system, the loss of oil in the sludge recovery section is lower.

Under 700 atm. operating conditions the asphalt destruction is also improved. This leads to much easier handling of the intermediate products and also to an improved efficiency of oil recovery in the carbonization of the final sludge residue. 700 atm. operation gives no reduction of hydrocarbon gas make in the coal liquefaction stage. Presumably this is because the alkaline catalyst conditions are, other things being equal, less favorable from a standpoint of gas production than tin and chlorine. Table I shows yields of hydrocarbon gases when making motor fuel from different raw materials by hydrogenation.

The over-all improvement in gasoline plus middle oil production from bituminous coal when using 700 atm. is roughly

Part of the team of U. S. petroleum technologists waiting in a suburban station in London before embarking on a mission to Germany. Left to right—Vladimar Haensel, Universal Oil Products Co.; L. P. Evans, Socony-Vacuum Oil Co., Inc.; William W. Odell, Bureau of Mines; Paul K. Kuhne, Gulf Oil Co.; Lester L. Hirst, Bureau of Mines

4-5% on the a.m.f. coal, equivalent to 7-8% improvement on the 300 atm. results.

B—Brown Coal Hydrogenation

The Leuna plant was forced to turn over to brown coal tar hydrogenation as a result of air raid damage in 1944 but prior to this the main raw material at this factory continued to be brown coal. The capacity of the plant had been considerably increased to more than 1,000,000 tons of dried brown coal per year. Bayermasse was used as catalyst. The Leuna plant suffered from the disadvantage that the pressure was low (230-250 atm.). There have been no major modifications of the process since the war.

Rhine brown coal is hydrogenated at Wesseling to give about 200,000 tons per year of finished product. This particular brown coal is "older" than the middle German coals and the coal liquefaction stage is operated at 700 atm.

C—Brown Coal Tar Hydrogenation, T.T.H. and M.T.H. Processes

The three Brabag plants, Bohlen, Magdeburg and Zeits, have continued to operate on brown coal tar and one of the newer plants, the Hermann Goering Factory at Brux also operates on this raw material. The output of finished products from the three Brabag plants has been of the order of 250,000 tons a year each, while the Brux plant has a capacity of 400,000 tons a year. At Bohlen, Magdeburg and Brux the process was in all major respects identical to that operated before the war, with the exception that iron on active coke had replaced molybdenum on coke as liquid phase catalyst. This was necessary because of the scarcity of molybdenum.

The above brown coal tar plants produced motor fuel and aviation gasoline and also a certain amount of diesel oil. Latterly they produced considerable quantities of jet fuel.

The Brabag plant at Zeits operated under entirely different conditions using a process developed by the Ludwigshafen Research Department. This, the T.T.H. process, consists of a single-pass treatment of crude brown coal tar over an active hydrogenation catalyst under low temperature conditions. The refined tar product is fractionated to give low quality petrol, a moderately good diesel oil, a refined wax and lubricating oil.

In order to reduce its solids to less than 0.1% the tar is first fugalled and filtered. The fugalled tar is then preheated with hydrogen (2,500 m³ hydrogen per ton of oil) and fed to reactors operating at 300 atm. and an average temperature of 360°C. The catalyst employed is tungsten sulphide (5058) or a new saturation catalyst (8376) which will be described later under vapor phase hydrogenation. The throughput is 1 kilo per liter of catalyst per hour. Catalyst life is of the order of six months. The hydrocarbon gas make is 1-2% of the fresh feed and the hydrogen absorption 500-550 m³ per ton of tar.

The crude product is worked up to give 25% by weight of gasoline with an octane number of only 55-60 motor method, 50% diesel oil with 50-55 cetane number, 10-15% of refined wax and 10-15% of lubricating oil which had a good viscosity index but a low absolute viscosity. The refined wax obtained by this process is particularly suitable, because of low sulphur content, for oxidation to carboxylic acids, or for cracking to olefins for synthetic lubricating oil manufacture. It was said that lately most of the wax product had gone to Stettin for lubricating oil manufacture.

Zeits also operated a modified version of the above process, known as the M.T.H. process. The conditions here are substantially the same as for T.T.H. except that throughput is lower and the temperature higher (390°C). The crude product consists of 35% gasoline, 60% diesel oil and 5% heavy bottoms which were probably sent to Bohlen for liquid phase hydrogenation. The hydrocarbon gas make is roughly 6% and the hydrogen absorption 650-700 m³ per ton of tar.

D—Bituminous Coal Tar Hydrogenation

Bituminous coal tar is hydrogenated at Politz and at Lutzkendorf. Bituminous coal tar pitch is used as raw material at Welheim. When treating crude tar it is usually distilled to give middle oil, which goes direct to the vapor phase stages, and a light pitch, which is hydrogenated at 700 atm., using the same catalyst conditions as are employed for hydrogenation of heavy fractions of brown coal tar.

E—Petroleum Oil Residues

Residues from the distillation of crude petroleum and heavy residue from cracking operations are hydrogenated in the liquid phase at Politz. A pressure of

TABLE 1—Hydrocarbon Gas Production when Making Motor Gasoline from Different Raw Materials by Hydrogenation (25 tons/hr. = 200,000 tons/yr.)

Raw Material	Bitum. Coal t./hr.	Bitum. Coal High Temp. Tar, t./hr.	Natural Oil Residuum t./hr.
Liquid Phase			
Methane	2.3	1.3	0.96
Ethane	2.0	1.2	0.63
Propane	2.6	1.5	1.16
n-Butane	1.3	0.76	0.95
i-Butane	0.16	0.09	0.02
Total	8.36	4.85	3.72
Saturation			
Methane	0.13	0.13	0.08
Ethane	0.10	0.10	0.06
Propane	0.27	0.27	0.17
n-Butane	0.16	0.16	0.10
i-Butane	0.16	0.16	0.10
Total	0.82	0.82	0.51
Splitting			
Methane	0.028	0.037	0.035
Ethane	0.014	0.018	0.016
Propane	0.28	0.37	0.35
n-Butane	0.24	0.32	0.30
i-Butane	0.71	0.94	0.90
Total	1.272	1.685	1.601
Overall			
Methane	2.46	1.47	1.08
Ethane	2.11	1.32	0.71
Propane	3.15	2.14	1.68
n-Butane	1.70	1.24	1.35
i-Butane	1.03	1.19	1.02
Total	10.45	7.36	5.84

700 atm. is employed. At Lutzkendorf, asphaltic residues obtained from the lubricating oil plant are also hydrogenated at 700 atm. The catalyst is the normal liquid phase catalyst, iron on activated coke.

F—Normal 300 Atm. Vapour Phase Hydrogenation

Vapor phase hydrogenation of the gasoline plus the middle oil product obtained from the liquid phase operations described above or from straight distillation of tars or crude petroleum is usually carried out in two stages. The first stage consists of saturation hydrogenation, the main object of which is the removal of the nitrogen compounds which reduce the reactivity of the oil in the second vapor phase splitting hydrogenation step. It is usual to fractionate the crude saturation product from the first stage into gasoline and middle oil, only the latter going forward to splitting hydrogenation. The main reason for this is to segregate the comparatively poor quality saturation stage gasoline from the main splitting hydrogenation product. The saturation stage gasoline is frequently used as feed for the D.H.D. process which is described later.

The saturation stage consists of once-through treatment at 300 atm. pressure and temperature of 400-410°C. over an active catalyst. Formerly the catalyst used was tungsten sulphide (5058) but this had now been largely substituted by a new catalyst developed by Ludwigshafen, which consists of 20-25% tungsten sulphide and 3% nickel sulphide supported on activated alumina (8376). It is claimed that this catalyst has as good an activity for the purification of oils from nitrogen, oxygen, etc., as 5058 but it causes less splitting to lighter products. This is advantageous because it reduces the amount of comparatively poor petrol made in the saturation stage. Actually, the impression was gained that the main reason for the employment of the new catalyst was the necessity to conserve tungsten and that the new catalyst was in certain respects, e.g. life, inferior to 5058.

It was also stated that Bohlen and Magdeberg had used 6434 (see below) as a saturation catalyst. Hydrocarbon gas make in the saturation stage is small, of the order of 1% on the oil treated.

The throughput through the saturation stall, expressed in kgms. per liter of catalyst per hour, varies with the nature of the feed. The determining factor is the temperature control of the converter, which is achieved by arranging the catalyst in beds with intermediate introduction of cold hydrogen. Aromatic feed stocks requiring a higher hydrogen absorption give rise to a greater heat of reaction and have to be fed at a lower rate.

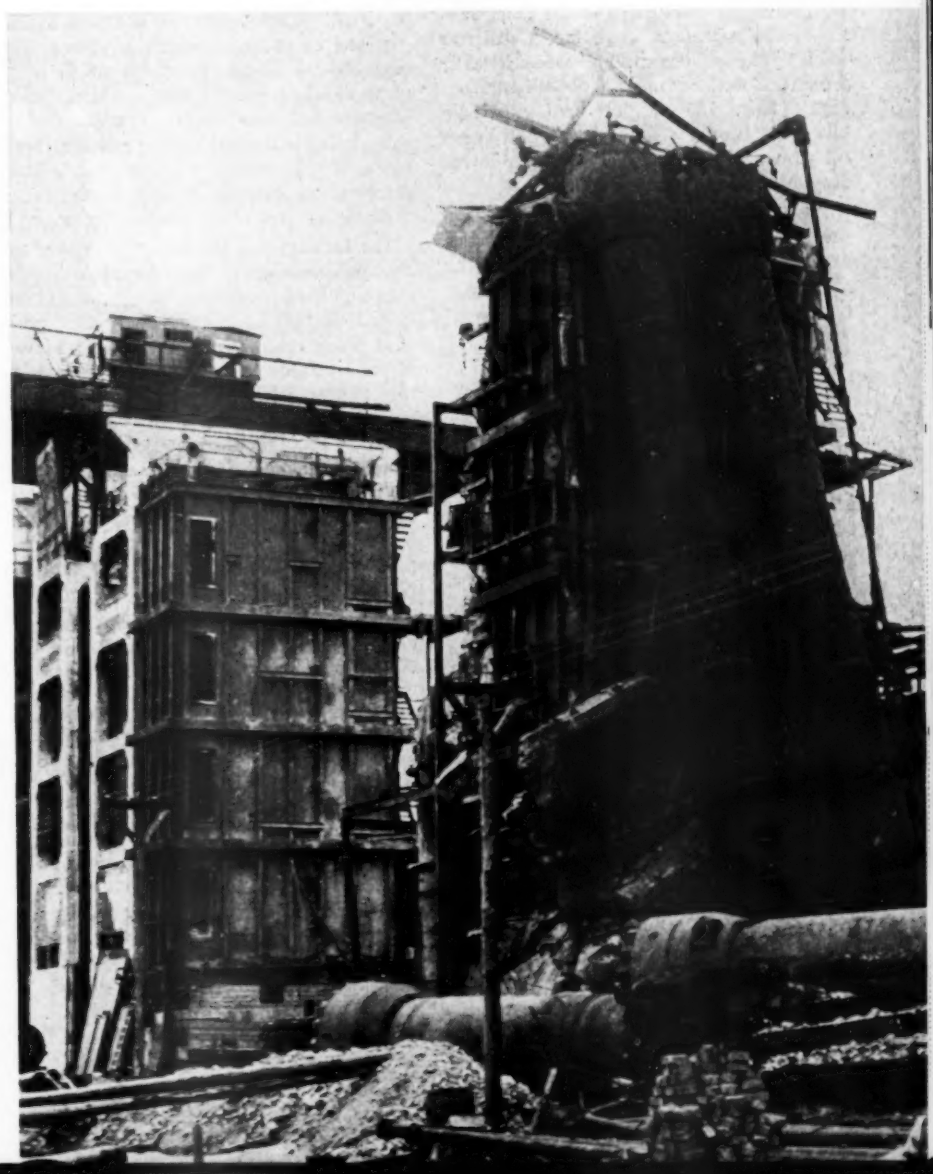
In the splitting hydrogenation stage, saturated middle oil is reacted over tungsten sulphide on activated Terrana catalyst (6434) at a temperature of 410-420°C and pressure of 300 atm. The pass conversion to gasoline is of the order of 60%. Hydrocarbon gas make depends on the end point and volatility of the petrol product. When making a motor gasoline of end point of about 180, it is about 12% by weight on the middle oil hydrogenated and this rises to 18-20% when aviation gasoline of 150 end point or 65-70% volatility at 100°C is the required product.

No catalyst other than 6434 has been used for large scale splitting hydrogenation at 300 atm. Other catalysts have been tried in the laboratory, particularly an iron on activated Terrana catalyst. None of these alternate catalysts have been found to be superior to 6434.

G—700 Atm. Vapour Phase Hydrogenation

An interesting development at the Welhein and Lutzkendorf plants has been the elimination of the saturation stage and the direct splitting hydrogenation of liquid phase gasoline and middle oil at 700 atm. In the case of Welhein, a new splitting catalyst is being used, probably consisting of 3% chrome oxide and 1% molybdic oxide supported on Florida earth. The I. G. Research Department at Ludwigshafen had been working on parallel lines and found this to be the optimum catalyst.

The reaction temperature is 450° C., some 30° higher than that employed in the normal 300 atm. process; but in spite of this, because of the lower reac-



A direct bomb hit on the high pressure coal hydrogenation plant at Gelsenberg caused the damage shown here. The two columns in an almost vertical position are reaction chambers. These reaction chambers, which operated at pressures above 10,000 psi, were enclosed inside "stalls", concrete and steel buildings which were designed to prevent the accidental explosion of one chamber from demolishing the entire plant

TABLE 2—Reaction Conditions for the D.H.D. German Aviation Gasoline Process

Pressure—25 atm. for brown coal tar and petroleum oil feeds. 50-70 atm. for feeds derived from coal hydrogenation and from bituminous coal tar.
Avg. Reaction Temp.—510-520° C.
Throughput—0.4 kgms. of fresh feed per liter of catalyst per hour.
Circulating Hydrogen to Oil Feed Ratio—Approximately 1000 m^3 per ton.
Yield data were given as follows:

	% by Weight of Feeds Derived From Bituminous Coal Hydrogenation and Bituminous Coal Tar	% by Weight of Feeds Derived from Brown Coal Tar and Petroleum Oil
Stabilized Crude D.H.D. Products	82–84	76–77
Hydrocarbon Gas Make	16	22–23
Carbon	0.1–0.2	0.5–1
Hydrogen Made in the Reaction	1	0.5

tivity of the feed oil, the amount of gasoline obtainable from a given reaction volume is little more than half that obtained in the normal splitting process. For a petrol product of the same volatility, the gas make in the 700 atm. process is some 5-6% greater than that obtained by the normal method. The chief advantage is the elimination of the saturation step and the production of a much more aromatic gasoline and therefore one having a higher octane number.

The aromatic content of the final gasoline is very dependent on the nature of the feed stock. Middle oil obtained by the liquid phase hydrogenation of pitch or bituminous coal or from the fractionation of bituminous coal tar gives rise to a gasoline containing around 45% aromatics and having an octane number of at least 78 without lead. Middle oils from brown coal or from petroleum oil give rise to gasolines of much lower aromatic conent.

At Lutzkendorf the use of 700 atm. pressure in the vapor phase plant was mainly for the purpose of eliminating the saturation step. The normal 6434 catalyst was employed.

H—D.H.D. Process

For the highest quality aviation gasoline the Luftwaffe insisted on a high aromatic content. The 700 atm. hydrogenation described above met this requirement, but only as far as very high aromatic middle oil feed stocks were concerned. Another method was therefore adopted for the main production of first quality aviation gasoline, which consisted of the dehydrogenation of the 80-185°C. cut of gasolines obtained from petroleum distillation or by 300 atm. splitting hydrogenation of coal and tar products.

In particular, this process was applied to the comparatively low quality gasoline distilled from the crude saturation stage product. Usually, the naphtha cut was 80-85% by weight of the original petrol. The process is discontinuous, reaction periods of rather more than 100-150 hours for bituminous coal naphthas and about 60-80 hours for brown coal and petroleum feeds alternating with 20-24 hour catalyst reaction periods. The usual reaction conditions were as given in Table 2:

The hydrocarbon gas made in the reaction is roughly made up of equal proportions of C_1, C_2, C_3 and C_4 hydrocarbons. Heavy polymer is formed during the reaction and re-distillation of the crude product to an end point of 180°C. left a residue of approximately 4% by weight.

The method of operation during the reaction cycle is as follows:

Fresh feed and recycle gas (containing 50-65% by volume of hydrogen) is heated by interchange with the outgoing product and with a gas fired preheater to a temperature of 500°C. It then enters the first of a series of converters, usually four or five in number. The reaction volume of each converter is 9-10 m^3. Each converter contains a single bed of catalyst, which is active alumina on which has been deposited 10% of molybdic oxide. The reaction being strongly endothermic, it is necessary to reheat the reactants before passing them from one converter to the next. This intermediate heating is done in the same furnace as the main preheating step.

On leaving the last reaction converter, the products are interchanged with incoming feed and the temperature reduced to 300°C., after which they pass to a final refining converter for removal of unsaturated products by hydrogenation. The catalyst in this refining stage is usually the same as is used in the D.H.D. reaction but it is possible to work with 80% D.H.D. catalyst and 20% activated Terrana with no metal addition. The product is finally cooled by further interchange with the feed and by water coolers, let down to atmospheric pressure, stabilized and redistilled. The final distillate is blended back with the light fraction of original gasoline.

Gaseous products produced in the process are purged, (a) as dissolved gas released on letting down the crude product, and (b) as a purge from the recycle gas system.

For the catalyst regeneration cycle the whole apparatus is let down and purged with inert gas obtained from a previous regeneration cycle. Carbon is then burnt off the catalyst by introducing air to each oven, the concentration of oxygen at the inlet of each oven being 3-4% by volume of the ingoing gas. A pressure of about 400 atm. is maintained and inert gases are circulated continuously using the same circulator as used during the reaction period. Cold inert gas can be introduced between the converters in order to control temperatures, which must not exceed 530°C. With properly controlled reactivation, the life of a batch of catalyst is about 12 months.

The final D.H.D. naphtha contains 65-68% aromatics and when blended back with the corresponding light gasoline fraction gives a finished D.H.D. gasoline with an aromatic content of 40-55% and a minimum octane number of 78 unleaded or 87 with 0.09 vol.-% of tetraethyl lead. The octane number of D.H.D. gasoline made from coal hydrogenation and bituminous coal tar products is at least 2 units higher.

The important feature in the manufacture of D.H.D. catalyst is the use of carefully prepared activated alumina. The I. G. make this themselves, either by precipitation from aluminum sulphate or sodium aluminate. The active alumina is impregnated with ammonium molybdate solution. The product is dried and finally calcined to remove ammonia at about 400°C.

It has already been pointed out that, when aromatic middle oils are available, direct 700 atm. gas phase splitting hydrogenation can produce a gasoline of practically the same quality as that obtained by the 3-stage saturation/300 atm. splitting/D.H.D. method. It is therefore interesting to compare the yield efficiencies of these two processes.

The single-stage process gives a yield of about 83% of final gasoline. The first two steps of the multi-stage process produce from the same raw material 89% by weight of the normal hydro gasoline. This on distillation gives 73.5% of naphtha and 15.5% of light gasoline, both expressed as % by weight on the original feed stock. Treatment of the naphtha by the D.H.D. process gives 60% by weight on the original middle oil of redistilled naphtha, which, when blended back with the light gasoline, gives a total of 75.5% by weight of final aromatic petrol. Thus, in addition to the multi-stage process being much more complicated to operate, it would appear to give 9% less final product than the direct 700 atm. hydrogenation process.

It is also interesting to note that the yield of finished D.H.D. gasoline from brown coal tar or petroleum middle oil calculated in the same way as above is only 71-72%. This compares with an 89-90% yield of ordinary 6434 hydro gasoline, showing that the Luftwaffe was prepared to sacrifice up to 20% in output in order to obtain a highly aromatic fuel. In assessing this cost of the improvement in aromatic content, it must of course be borne in mind that the hydrocarbon gases, particularly the butane produced in the D.H.D. process, could be used for increasing the output of other aviation components, such as isooctane or alkylate.

The D.H.D. process was first tested

out on a large scale on a modified vapor phase hydrogenation stall at Politz. This plant also had the first properly designed commercial unit, which started up at the beginning of 1942. D.H.D. plants have also been in operation at Scholven and Leuna and are in course of erection at Blochhammer, Bohlen, Brux and Ludwigshafen.

Naphtha dehydrogenation is also carried out on a scale of about 60,000 tons a year at Moosbierbaum. The D.H.D. process is not employed. A slightly modified version of the normal American "hydroforming" method is used.

I—Isooctane and Alkylate Production

The first method adopted in Germany for the production of isooctane consisted of the dehydration of iso-butanol (made by the higher alcohol synthesis from carbon monoxide and hydrogen) to give iso-butylene; the polymerization of this iso-butylene to di and tri isobutylene and the hydrogenation of the dimer and trimer. This process was operated at Ludwigshafen/Oppau and at Leuna in the early days of the war and is still the process employed at the new plants, Heydebrech and Auschwitz.

Iso-butanol of 97-98% purity is dehydrated over an alumina catalyst at a temperature of 330-360°C. The yield is 95% theory and the catalyst life from three to four months. Polymerization is carried out over a catalyst consisting of active carbon containing 10% phosphoric acid. Temperature is approximately 150°C. and pressure of the order of 20 atm., this being adjusted to insure liquid phase conditions at the reaction temperature employed. The polymer usually is redistilled to remove as bottoms only the polymers of greater molecular weight than trimer, and the distillate is hydrogenated at 250-300 atm. pressure over molybdenum sulphide catalyst (5615).

By 1940 the I. G. had developed a process for dehydrogenation of butane available from the hydrogenation plants and this opened up the second phase of branched paraffin production in Germany. Butane from the hydrogenation plants was fractionated into iso and normal butane, the normal butane was used for liquid gas and the iso-butane dehydrogenated. The resulting iso-butylene was worked up to isooctane as before.

The butane dehydrogenation process which was developed at Leuna is a continuous process operating at 550-570°C. and at substantially atmospheric pressure with a chromium on alumina catalyst (10-15% chromium). The process was made continuous by adopting the moving catalyst bed principle.

The catalyst, which was made in the form of spheres, passed downward through externally heated reactor tubes concurrently with the butane feed. The residence time of catalyst in the tubes is approximately 4 hours, after which it is removed to an external reactivation vessel. Reactivation is carried out by burning off deposited carbon with diluted air.

The rate of butane feed is about 700 m^3 per m^3 of catalyst per hour and 20-25% of the inlet butane is converted per pass. About 85% of the butane converted goes to butylene. Carbon content of catalyst leaving the converter is 4% and this is reduced to about 1.5% in the reactivation step. No attempt is made to burn off all the carbon in the inner core of the catalyst and there is a theory that the presence of a certain amount of carbon in regenerated catalyst helps to keep down carbon formation. The process was first operated on a large scale at Leuna, Politz and Scholven.

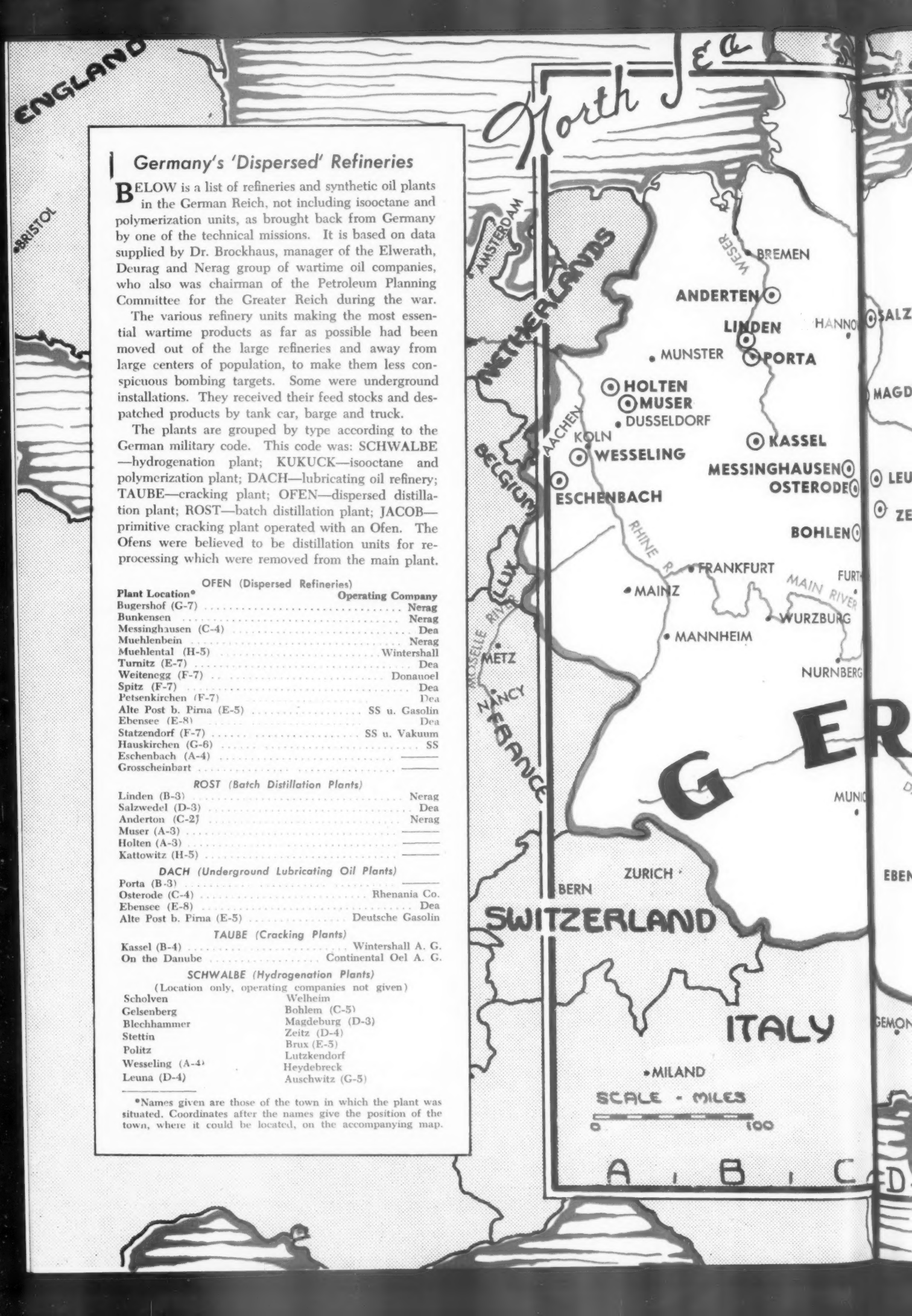
Early in 1942 there was a further change which resulted in a greatly increased potential output of branched paraffins. Normal butane was dehydrogenated instead of iso-butane. The resulting normal butylene was used to alkylate the iso-butane fraction giving a blending alkylate of about 92 octane number. The alkylation process was carried out with sulphuric acid in stirred vessels. The method was developed at Leuna and the Ludwigshafen staff could not provide any detailed information.

More German Data

In addition to the reviews of the reports of the U. S. Technical Oil Mission presented in the first section of this issue (pgs. R-851 through R-868) additional articles will be found on pgs. R-922 through R-932.

TABLE 3—Summary Data for German Hydrogenation Plants, Showing Type of Operation and Annual Yield of Finished Products

Plant	Main Raw Material	Type of Hydrogenation Process	D.H.D. Plant Installed or Working	Isooctane or Alkylate Plant working or Installed	Annual Capacity Finished Fuels Tons/year
Scholven	Bituminous coal	300 atm. liquid and vapor phase	Two units working	60,000 T/yr. alkylate plant operating	200,000
Gelsenberg	Bituminous coal	700 atm. liquid phase	None	None	350,000
Blechhammer	Bituminous coal	700 atm. liquid phase 300 atm. vapor phase	Two units not finished	Plant in course of erection	400,000
Politz	Bituminous coal, bituminous coal tar, petroleum residues	700 atm. liquid phase 300 atm. vapor phase	Four units working	60,000-70,000 T/yr. alkylate plant operating	600,000
Wesseling	Brown coal	700 atm. liquid phase	None	20,000-Ton/Yr. alkylate plant in course of erection	200,000
Leuna	Brown coal, brown coal tar	250 atm. liquid and vapor phase	Four units one working	60,000-Ton/yr. alkylate plant operating	600,000
Welhein	Bituminous coal tar fractions and pitch	700 atm. liquid and vapor phase	None	None	150,000
Bohlen	Brown coal tar	250-300 atm. liquid and vapor phase	Two units not ready	Alkylate plant in course of erection	250,000–300,000
Magdeburg	Brown coal tar	250-300 atm. liquid and vapor phase	None	None	250,000–300,000
Zeitz	Brown coal tar	300 atm., T.T.H. and M.T.H.	Two units not finished	None	250,000–300,000
Brux	Brown coal tar	Normal 300 atm. liquid and vapor phase	Two units not finished	Alkylate plant in course of erection	400,000
Lutzkendorf	Bituminous coal tar, petroleum residues	700 atm. liquid and vapor phase	None	None	50,000
Heydebrech	Higher alcohols		None	Iso-octane plant partly working	
Auschwitz	Higher alcohols		None	Iso-octane plant partly working	
Stettin	Bituminous coal	700 atm. liquid phase	None	None	
			TOTAL TONS/YR. FINISHED FUELS.....		3,700,000



Germany's 'Dispersed' Refineries

BELOW is a list of refineries and synthetic oil plants in the German Reich, not including isooctane and polymerization units, as brought back from Germany by one of the technical missions. It is based on data supplied by Dr. Brockhaus, manager of the Elwerath, Deurag and Nerag group of wartime oil companies, who also was chairman of the Petroleum Planning Committee for the Greater Reich during the war.

The various refinery units making the most essential wartime products as far as possible had been moved out of the large refineries and away from large centers of population, to make them less conspicuous bombing targets. Some were underground installations. They received their feed stocks and despatched products by tank car, barge and truck.

The plants are grouped by type according to the German military code. This code was: SCHWALBE—hydrogenation plant; KUKUCK—isooctane and polymerization plant; DACH—lubricating oil refinery; TAUBE—cracking plant; OFEN—dispersed distillation plant; ROST—batch distillation plant; JACOB—primitive cracking plant operated with an Ofen. The Ofens were believed to be distillation units for reprocessing which were removed from the main plant.

OFEN (Dispersed Refineries)

Plant Location*	Operating Company
Bugershof (G-7)	Nerag
Bunkensen	Nerag
Messinghausen (C-4)	Dea
Muehlenbein	Nerag
Muehlental (H-5)	Wintershall
Turnitz (E-7)	Dea
Weitenegg (F-7)	Donauoel
Spitz (F-7)	Dea
Petsenkirchen (F-7)	Dea
Alte Post b. Pirna (E-5)	SS u. Gasolin
Ebensee (E-8)	Dea
Statzendorf (F-7)	SS u. Vakuum
Hauskirchen (G-6)	SS
Eschenbach (A-4)	———
Grosscheinbart	———

ROST (Batch Distillation Plants)

Linden (B-3)	Nerag
Salzwedel (D-3)	Dea
Anderton (C-2)	Nerag
Muser (A-3)	———
Holten (A-3)	———
Kattowitz (H-5)	———

DACH (Underground Lubricating Oil Plants)

Porta (B-3)	———
Osterode (C-4)	Rhenania Co.
Ebensee (E-8)	Dea
Alte Post b. Pirna (E-5)	Deutsche Gasolin

TAUBE (Cracking Plants)

Kassel (B-4)	Wintershall A. G.
On the Danube	Continental Oel A. G.

SCHWALBE (Hydrogenation Plants)

(Location only, operating companies not given)

Scholven	Welheim
Gelsenberg	Bohlem (C-5)
Blechhammer	Magdeburg (D-3)
Stettin	Zeitz (D-4)
Politz	Brux (E-5)
Wesseling (A-4)	Lutzkendorf
Leuna (D-4)	Heydebreck
	Auschwitz (G-5)

*Names given are those of the town in which the plant was situated. Coordinates after the names give the position of the town, where it could be located, on the accompanying map.

Baltic Sea
LITHUANIA
KONIGSBURG
ELBING
STETTIN
SALZWEDEL
BERLIN
MAGDEBURG
POZNAN
WARSAW
POLAND
ELBE RIVER
ODER RIVER
LEUNA
ZEITZ
DRESDEN
BRUX
ALTE POST
AUSCHWITZ
MUHLENTAL
KATTOWITZ
PRAGUE
CRAKOW
PILSEN
MULHAUSEN
BRUNN
HAUSKIRCHEN
GERMANY
DANUBE RIVER
SPITZ
STATZENDORF
BUGERSHOF
PETZENKIRCHEN
WEITENEGG
EBENSEE
TURNITZ
VIENNA
ROTTE
BUDAPEST
GRAZ
HUNGARY
BALATAN LAKE
ZAGBEB
ROMANIA
YUGOSLAVIA
BEOGRAD
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Four Underground Lubricating Oil Plants Were Being Constructed by the Germans

New Type of "Endless Chain" Dewaxing Filter Was Incorporated in Porta Plant, Built in Old Sandstone Quarry and Approximately 90% Complete

FOUR underground lubricating oil plants had been set up by the Germans as part of their wartime petroleum operations, it was learned by the technical oil missions dispatched from this country.

One plant was located at Porta, near Minden, in an old sandstone quarry. Another was under construction in Osterode, in the Hartz mountains, by the Rhenania company. This plant which was to operate principally on Vienna crude, was to be larger than the Porta and it was planned to do furfural extraction there. A third plant was being erected by D.E.A. in Ebensee, in Austria, where dewaxing was to be done using dichlorethane. This plant was to operate in connection with one of the "dispersed" refineries. The fourth underground lubricating oil plant, it was understood, was to be built in connection with a "dispersed" refinery at Alte Poste, near Pirna, operated by the Deutsche Gasolin. This also was probably to do dewaxing using dichlorethane.

The only detailed description of any of these plants contained in the first reports of the technical missions is for the installation at Porta. This underground lubricating oil refinery was found nearly completed at the end of the war. It was to have a capacity of 280 tons a day of topped crude, which was to be received by tank wagon from various "dispersed" distillation units. Fig. 1 is a sketch of the layout of the Porta plant.

Many Products to be Made

The distillation equipment at the Porta plant was a Coubrough unit which was to take off gas oil, spindle oil, neutral oil and a light cylinder oil in the first stage and, in the second stage, (using a 1:1 kerosine mixture and a vacuum of 25 mm.) was to distil off a heavy cylinder oil, leaving about 20 % bottoms. In the case of aircraft engine oils, a distillate having a 12° Engler viscosity at 70° C. was to be prepared, leaving a 40/50 penetration asphalt as residue.

The lubricating oil fractions were to be furfural treated, dewaxed by solution in a mixture of trichlorethane and trichlormethane and then contact filtered using clay. No acid treatment was to be used as during the war color of an oil was considered to be immaterial.

The most novel feature of the underground lubricating oil refinery at Porta, it was said, was the dewaxing plant. The management had decided to give up the installation of a conventional Dorr-Oliver filter, which was originally installed at Misburg, because of the distortion of the filter drum. A new type of filter was to be used which had been devised by Edeleanu Gesellschaft. The main change from the conventional Dorr-Oliver filter is that the filtering is done on a type of endless chain, which allows each section to have a more thorough washing than with the conventional design.

More details on the Porta underground "lube" oil plant are given in a report prepared by J. A. Oriel, on behalf of the British Ministry of Fuel and Power, and W. A. Horne and J. P. Jones, of the U. S. Technical Industrial Intelligence Committee, after a visit to the plant. Their report, "Dachs I Lubricating Oil Plant" (Index No. 293) is as follows:

Details of Porta Plant

"This is an underground plant for producing aviation lubricating oil from topped crude oil to be supplied from the Hanover area. It is located in an old sandstone quarry. The existence and location of this plant were disclosed by Dr. von Evnatten and Freiheir Heeremann, managers of the lubricating oil plant at Misburg. Arnold Schroeder, a Hollander, was in charge of the installation of the various units. He was later placed in charge of feeding the inmates of a large displaced persons camp in Minden but he served as a guide when the plant was visited in May, 1945.

"The plant office at Porta was organized on Aug. 4, 1944, to plan necessary further excavation of the old sandstone mine and construction of the plant, which was to be built under the Geilenberg plan by the Todt organization. Thus, all work was carried out under the supervision of the German storm troopers.

Plant Was 90% Complete

"The plant was approximately 90% complete, with 95% of the equipment in location. Installation would have been completed in an estimated six weeks from the date of occupation of our troops. All plans and records were removed by the SS two days before the occupation took place. Due to the lack of ventilation and to water seepage, most

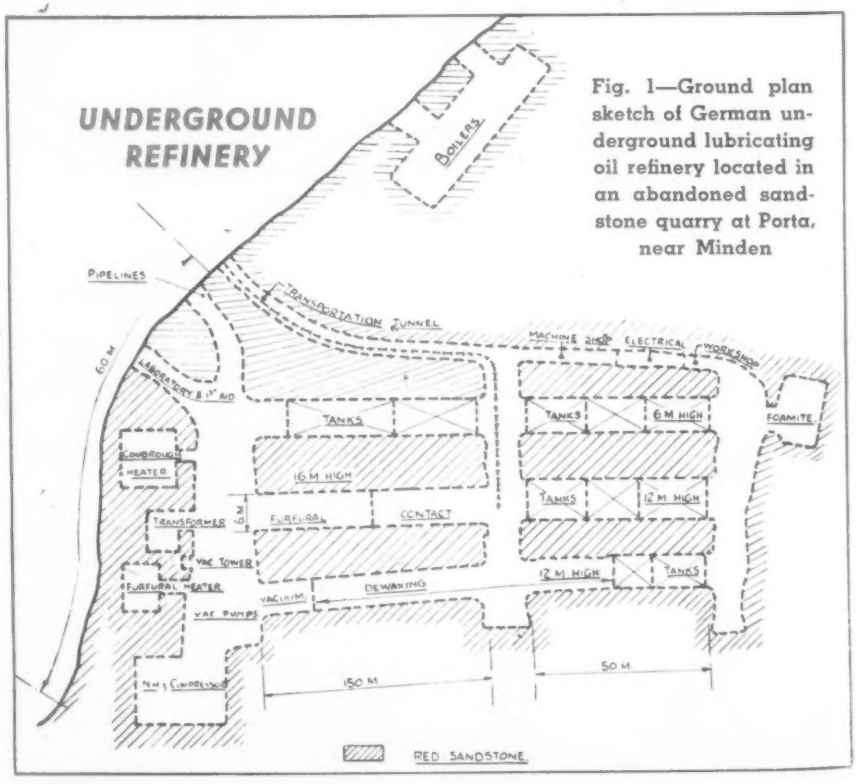


Fig. 1—Ground plan sketch of German underground lubricating oil refinery located in an abandoned sandstone quarry at Porta, near Minden

of the iron and steel equipment was rusting rapidly. The plant consisted of 5 units, with an estimated in-place value of approximately $2,000,000.

"**Distillation:** Distillation was carried out in a two-stage Coubrough unit, the headers and columns having been moved to this location from the Nerag refinery at Misburg. The primary stage had a capacity of approximately 9000 tons a month of topped crude, which was to be brought by tank car from the Hanover district. The first column was to take a naphtha cut overhead and side streams of Diesel oil and neutral oil. The bottoms were to be charged with naphtha in equal volume proportions to the second column at some reduced pressure, where a heavy cylinder oil cut was to be taken overhead, reducing the bottoms to approximately 20% of asphalt. The Diesel oil, wax and asphalt were to be shipped out and, as far as known, to be used without further treatment. A small amount of piping was required for completion of the distillation section.

"**Extraction:** The neutral and bright stocks were to be furfural extracted for the workup of aviation lubricating oils. This unit was designed by Still G.m.b.H. Rechlinghausen near Hoexter-am-Weser and apparently was of the usual design. Installation of pumps, piping and insulation was complete.

"**Dewaxing:** This unit was one of the most recent designs of Edeleanu Gesellschaft, using methylene dichloride and ethylene dichloride as solvents followed by a continuous band filter. The filter was a new and interesting development. There were four such filters of the latest improved design, which were constructed by R. Wolf of Magdeburg. This unit required some insulation for completion. An earlier model of this continuous band filter had been in use at the A. G. Sachsische Werke at Espenhain.

"**Clay Contacting:** Following the dewaxing and solvent recovery, the oil was to be batch clay contacted in quite conventional manner. These contactors and filters were also brought in from the Nerag refinery at Misburg. These oils were to be blended and used without further treating.

"**Clay Extraction:** This unit was to be located outside the mountain and was simply to consist of a batch naphtha extraction of the used clay from the contacting to recover the last traces of lubricating oil. The oil, after flashing off the gasoline, was to be used as motor oil without any treatment.

"**Auxiliary Equipment:** Concrete tanks inside the mountain provided working tankage (4000 m³ total), whereas the feed and product storage was to be in bunkers on the mountainside.

"A small steam plant had been constructed outside the mountain and was ready for operation. It was designed for 35 tons/hour of 22 atm. steam. This plant had originally been constructed for the use of another enterprise. Two other steam plants were to be constructed in the mountain. Although installations had not been started, all the parts were on the site and it was estimated that it would require 6 weeks for completion.

"Water for the plant was to be supplied by four pumps at the Weser River, which were to deliver 400 m³/hour at 12 atm. pressure. The water discharge was to flow back to the Weser through an open sluice.

"It was further planned to seal up the main opening through which the units had been brought, with approximately 8 ft. of concrete as bomb protection. In this same tunnel the offices and control laboratories were to be built. A single blower in the rearmost tunnel was to provide necessary ventilation. By the use of sealing doors or cross tunnels and vents the air was to be drawn in two of the lateral tunnels and blown out the other two."

E. L. Baldeschwieler, Standard Oil Development Co., Elizabeth, N. J., in front of a bombed out oil plant in Germany

Synthetic Lubricants Made At Two Plants in France

By Lt. R. C. Aldrich, U.S.N.R.

In order to study the methods used by the Germans in making synthetic lubricating oils, field trips were made by Navy technologists to study at first hand the operations of a commercial plant at Lestaque and a pilot plant at Harnes, both in France. In the principal operation a gas oil from Fischer-Tropsch operations was chlorinated, then treated with benzol and dichlorethane in the presence of aluminum chloride. One product secured was a high grade steam cylinder oil for use with superheated steam.

These German processes for the manufacture of lubricating oils by synthesis are described in TIIC report "Synthetic Lubricating Oil Production in France" (Index No. 365), which is published below.

THE MANUFACTURE of synthetic lubricating oils is a subject of vital interest at this time to the U. S. Navy. Not only are the processes themselves important, but the quality and usefulness of the products obtained are subjects which call for careful study. It has been known for some time that the Germans have been using synthetic lubricants for all types of service since the outbreak of the war. Some details of their work are now available here in France.

In order to equip the Navy with a background on this subject, two field trips were made to study French plants producing synthetic lubricating oils; first to the Kuhlmann Co. at Harnes (Lille) and second to the Standard Kuhlmann plant at Lestaque (Marseille). The former is only a pilot plant but operates on a process developed in Germany. The latter produces 25 tons of products per day and uses a process developed especially by the French which is probably not well known at this time outside of their country.

Both processes are also interesting in that they use as a basic raw material gas, oil or naphtha made by the Fischer-Tropsch process. Should a plant using this process be built in the U. S. the offtake could be used to make lubricants if these products ever come into demand.

(a) Standard Kuhlmann-Lestaque

Description of Process

This process uses Fischer-Tropsch gas oil, benzol and dichlorethane as raw materials. To make one ton of finished lubricants, 600 kg. of gas oil are required, 600 kg. of benzol and 160 kg. of dichlorethane. The gas oil should be just as paraffinic as possible; that is, the

TABLE 1—Inspection of Synthetic Oils—Standard Kuhlmann Co.—Lestaque

Designation	API Gravity	Viscosity 122° F.	Viscosity 212° F.	Viscosity 392° F.	V.I.	Flash °F.	Hard Asphalt c/o Meth. SNCF Spec. 179	Pour Point °F.
Spindle	15.9	42-73	.....	....	...	284	....	27
Transformer A	17.4	84 max.	.....	....	...	311	....	23
Transformer B	17.4	84 max.	.....	....	...	311	....	— 4
Turbine	15.9	95-110	.....	....	...	356	....	—10
Motor 1	15.9	281 max.	.....	....	>70	419	....	10
Motor 2	14.4	563 max	.....	....	>70	446	....	5
Cylinder Oils								
Saturated Steam	12.1	.....	96-121	....	...	392	<0.6	....
Low Superheat	12.1	1370-2300	.....	....	>60	518	<0.4	27
High Superheat	12.1	.....	350-480	....	>80	572	....	43
Very High Superheat	12.1	.....	350-480	....	>80	572	....	43
Heavy Machine Oil	...	84	.....	....	...	271	....	....

Note: These specifications are the minimum. In general standard Kuhlmann can produce better than the above.

TABLE 2—Analysis of Synthetic Lubricating Oils—Kuhlmann Co.—Harnes

	Lube F-2	Lube S-3	Lube 5/6	Lube 25/30
API Grav.	38.0-39.0	37.0-38.0	35.0-37.0	33.0-35.0
Viscosity, SSU				
at 68°F.	209-281	.....	.....	.....
at 122°F.	65-83	102-121	174-210	880-1050
at 212°F.	35-39	39-43	50-54	103-121
V. I.	70 (approx.)	70	85	82
Flash, °F. (Luchaire)	275	293	320	.....
Flash, °F. (Open cup)	293	311	.....	446
Fire, °F. (Open cup)	347	356	374	518
*Neut. No.	0.2-0.4	0.1-0.3	0.1-0.2	0.1
*Pour Point, °F.	—22	—13	—5	23
Carbon Residue, %	.01	.01	.02	.05
Ash, %	.02	.02	.05	.05
Use	Refrigerating machines	High speed & transmission	Engines & transformers	Engines & compressors

* Methods possibly differ from A.S.T.M.

Fischer-Tropsch process should be carried out with an H_2/CO ratio of 2/1 and the temperature of the reactors held down to 190°C in order to produce as few olefins and as many paraffins as possible. The end point of the distillation should not be above 350°C. The benzol used is not a pure compound but contains some toluene and a little xylene. Its end point should not be over 150°C.

The gas oil is first chlorinated in nine lead-lined tanks arranged in series. The flow is countercurrent, that is, the gas oil enters the first tank and is contacted by chlorine which has already passed through the other eight tanks. Raw chlorine enters the last tank into which the gas oil flows. This reaction is slightly exothermic and the heat of reaction is removed by water cooled coils. No mechanical agitation is needed, as the chlorine supplies sufficient agitation in bubbling through the gas oil.

The temperature of the reaction is aproximately 90-100°C., chlorine and hydrochloric acid leaving the last tank are passed through a conventional gas oil absorption unit to remove any valuable gas oil entrainment. The hydrochloric acid is used at this plant for other chemical processes.

The benzol and dichlorethane are mixed in the presence of aluminum chloride in a special mechanically agitated tank. The benzol enters at one end of the tank while the dichlorethane is injected through the sides. The temperature is maintained at 70°C. The tank is divided into three sections, each having an agitator and dichlorethane injection line.

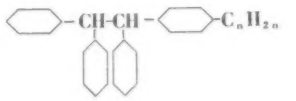
In a similar tank having six instead of three compartments, the chlorinated gas oil and benzol-dichlorethane are mixed, also in the presence of aluminum chloride. The benzol-dichlorethane enters the end of the drum, while the gas oil is injected through the side. The temperature is held at 70°C.

The reaction is terminated in a third such tank. No side injection occurs but the temperature is raised to 110°C. Following this, no chemical changes or condensation are thought to take place. The total time in passing through the three tanks is six hours. The total quantity of aluminum chloride used is 10% by weight.

The liquid product is next put through a stripping tower with open steam where the uncombined benzol is removed. This is used over again. The stripped oil is now sent to a horizontal settling drum, where the products settle into two layers. The upper is decanted as the high grade product, while the lower, containing sludge, is of inferior quality. The aluminate is washed from the sludge by water. In order to lower its viscosity the washed polymer is blended with gas oil. No further treatment is required. This oil is used for general machine lubrication where a high grade quality is not needed.

The upper layer, after decantation, is given a conventional clay treatment. It is then sent to a pipe still with two side streams. The overhead product is gas oil which is sent back for reprocessing. The upper side stream is transformer oil. The bottoms product is a very high grade steam cylinder oil which can be used at superheat temperatures up to 350°C. The present volumetric breakdown of these products is 20% recycle gas oil, 30% transformer oil, 30% turbine oil and 20% steam cylinder oil.

As already mentioned, the quality of the upper layer is extremely good (See Table 1). The viscosity index is approximately 100 for the lubricating oils. This is due to its unusual chemical makeup; as the oil consists of a polybenzene with a long saturated paraffin chain added on. The oil is then roughly half aromatic and half paraffinic giving it both a high viscosity index and a low pour point. A typical structure of this molecular arrangement is:



(b) Kuhlmann Co.-Harnes

This process starts with the gasoline product from the Fischer-Tropsch process. Under normal conditions, this product will contain 50% aliphatic paraffins and 50% olefins. The olefin content on the gasoline can be increased in the Fischer-Tropsch reaction by lowering the normal H_2/CO ratio from 2/1 to 1/1 and also raising the temperature.

The gasoline is mixed with 3% aluminum chloride and placed in a revolving cylindrical drum with steel balls in the bottom to increase contact surface. This reaction takes place at room temperature and requires 5 hours.

At the end of the reaction two layers are formed, the lower a heavy polymer chemically bound with aluminum chloride and the upper a layer of paraffinic gasoline and free polymer. These are separated in a decanter. The heavy tar is treated with NaCH and washed with water, giving an aluminate, NaCl and a lube oil produced.

The free polymer and gasoline are allowed to stand for 4-5 days in order to completely separate. The light or upper cut is steam stripped to remove the gasoline, which is used as motor fuel. The gas oil and lube remaining after steam stripping are clay treated and filtered. The resulting oils are a gas oil, a light lube suitable for cold service and a heavy lube for ordinary lubrication.

At present this heavy cut is being hydrogenated for special use. This is being done at 100 atm. pressure and 200°C. with standard Fischer-Tropsch catalyst (cobalt-thorium-magnesium-kieselguhr). This produces a substance similar to vaseline.

The quality of these lubricating oils is not exceptionally good. Their "oiliness" is poor and they apparently oxidize readily. (See Table 2)

Fischer-Tropsch and Hydrogenation Plants In Ruhr Valley Studied by Joint Mission

Ten Plants Visited. Production Know-How Picked Up, but No Evidence Is Found of Developments to Offset Economic Disadvantages of Both Processes

INDICATIONS that the German government had discontinued the construction of Fischer-Tropsch plants during the war and was planning to build additional hydrogenation plants were found by a mission of British-American technologists on a tour of Ruhr valley plants in April, 1945.

This was claimed by some German scientists at the Fischer-Tropsch plants, it was said, to be due to the influence of I. G. Farbenindustrie officials with the German government. "I. G. officials dominated the appropriate ministry and pushed the merits of hydrogenation," one German technologist was reported as telling the investigators.

The objective of the combined group of British and American petroleum technologists on their inspection in the Ruhr was a study of new developments by the German industrialists in the operation of Fischer-Tropsch and hydrogenation plants, and the interlinking of these plants with the German chemical manufacturing industry. Ten plants were visited.

U. S. Oil Men on Mission

The U. S. representatives on the joint mission included: E. L. Baldeschwieler, Standard Oil Development Co.; Ernest Cotton, Gulf Oil Corp.; Vladimar Haensel, Universal Oil Products Co.; Lester L. Hirst, Bureau of Mines; Guenther von Elbe, Bureau of Mines; A. R. Powell, Koppers Co., and Dr. E. Peck.

Their conclusions are summarized as follows in the report: "CIOS Investigation of Ruhr Synthetic Oil Plants," (Index No. 17):

1—While a number of interesting and novel wartime developments were discovered, some of the visitors felt the Germans had not made a very impressive showing in scientific developments in these fields during the war. This was believed due mainly to their concentration on maximum production, rather than on new methods and processes.

"Some of the technical developments, particularly in the oil side, seem rather amateurish," one investigator stated.

2—There is no evidence of developments which have made either the Fischer-Tropsch or hydrogenation processes more attractive from the standpoint of economics. It was recognized, however, that conditions in Germany in wartime were remote from the economics of peacetime operations in either the U. S. or Britain.

3—The final reports on these visits will give the petroleum and other industries in the U. S. a good working knowledge of the Fischer-Tropsch and hydrogenation processes.

Fischer-Tropsch

The seven synthetic oil plants using the Fischer-Tropsch process which were visited were: Sterkrade-Holten Ruhrbenzein—Ruhrchemie A. G.; Kaiser Wilhelm Institut—Mulkeim; Gutehoffnunschutte A. G.—Sterkrade; Castrop-Rauxel Plant—Klocknerwerke A. G.; Wanne-Eichel Plant—Krupps; Hosch-Benzin and Kamen-Dortmund Plants; and Lurgi, Frankfort.

Technical results of the mission following the study of these Fischer-Tropsch plants is summarized in the report as follows:

1—In the preparation and purification of synthesis gas no application was found of Lurgi pressure gasification with oxygen to the Fischer-Tropsch process in the Ruhr plants; although at Castrop-Rauxel a plant had been designed for the continuous production of synthesis gas from coke oven gas, using steam and oxygen at 10 atm. pressure.

2—Design plans were secured of the medium pressure 10 atm. catalyst ovens. While the Fischer-Tropsch plants were found to be so damaged by bombing that they could not be reconstructed in situ, it would be possible, it was said, to transport from Germany one or more medium pressure ovens and also atmospheric pressure ovens. The design of the medium pressure catalyst ovens is described as follows in the report:

Design of Medium Pressure Ovens

"These consist of a nest of pairs of vertical tubes, one inside the other. The catalyst lies in the annular space between the tubes. There is steam in the inner tubes and in the whole of the space between the outer tubes.

"The Taschen-Rohr—Ofen is a somewhat different arrangement—with single tubes containing a complex web of plates to dissipate the heat. There seems to have been some uncertainty at Lurgi as to what would be the proper design for 20 atm. pressure but we were told that the Italian plant was to have had standard double tube ovens.

"It has been suggested by one member of the party that the medium pressure

Dr. W. C. Schroeder, Bureau of Mines, Washington, (helmet removed) was field leader for the group of petroleum technologists in Germany. His four companions are members of the British technical mission

Ernest Cotton, Gulf Oil Co., Pittsburgh, a member of the Technical Oil Mission, stands in front of a "wichel ofen" in the Krupp Works in Essen. A "wichel ofen" is a wound reaction chamber used in the coal hydrogenation process

Fischer-Tropsch oven designs are of considerable interest in connection with any exothermic catalytic process carried out at constant temperature, e.g. the methanization of coke oven gas."

3—As regards catalysts used in the Fischer-Tropsch process, the Ruhr plants were found to be using the ordinary Co-Th-Mg-Kieselguhr catalyst, the preparation and purification of which is already known. As regards an iron catalyst, although the information secured at the time was not fully definite, the report states, it seems clear (a) that no German full-scale plants have been using iron catalyst, (b) that it was to be used, however, in the projected Italian plant.

4—Concerning the method of operation of the Fischer-Tropsch process the report states; "We are gradually building up information on the views of the Germans on the different factors of (a) varying pressure; (b) catalyst—cobalt or iron—and (c) working in several stages or recycling the gases.

"There was a good deal of talk about the projected recycling in the Hosch plant. Figures as to variations of yields as the above variables were changed made it appear that the use of iron catalyst is considered potentially very important. Information was secured about two- and three-stage working, combined with variations at each stage in the ratio of H_2 to CO."

5—Something was learned of the so-called "O.X.O." process, one of the new methods for making alcohol in connection with Fischer-Tropsch operations. There was to have been operated at Holten, states the report, a plant under the control of a subsidiary, the "O.X.O." Gesellschaft, for the treatment of Fischer-Tropsch C_{12} to C_{17} olefins at 150°C. and 150 atm. pressure over a cobalt catalyst to produce aldehydes. These were to be reduced to alcohols over a nickel catalyst at 180°C. and 150 atm. The alcohols were destined to be converted into sulphonic ester soaps. (See following article for more details on the "O.X.O." process.)

6—In general it was learned that the German government had discontinued the erection of new Fischer-Tropsch plants early in the war. This was contrasted with its policy of building further hydrogenation plants. It was suggested by some German authorities that the Fischer-Tropsch process had not been the success that had been anticipated in meeting wartime needs.

"On the other hand," states the report, "Dr. H. Otken at Lurgi stated that the Fischer-Tropsch process in the view of Lurgi officials was extremely important, particularly from the point of view of production of chemicals rather than light fuels. He said that Fischer-Tropsch had suffered because I. G. officials had dominated the appropriate ministry during the war and had pushed the merits of the hydrogenation process.

Hydrogenation

In the joint technical mission's examination of the hydrogenation process, three plants in the Ruhr were examined exhaustively. Their observations were thus summarized:

At the Wilheim-Bottrop-Stinnes A. G. plant; (a) both liquid and vapour phase stages were carried out at 700 atm.; (b) while the feed stock originally was to have been the extract from the Pott-Broche process, actually coal tar pitch was being used; (c) this plant was producing a higher grade aviation spirit than any other plant.

The Scholven-Hibernia A. G. plant was a fairly conventional 300 atm. coal hydrogenation plant but it was found to contain the important "D.H.D." aviation spirit plant, first heard about in Ludwigshafen, and also an isooctane plant.

The Gelsenkirchen-Gelsenber Bensin A. G. was a coal hydrogenation plant with coal stalls operating at 700 atm. and not very novel otherwise. "However, it did yield a complete haul of documents" the report adds.

The technical highlights in the application of the hydrogenation process in Germany, based on the inspection of these three plants, are as follows:

1—In coal hydrogenation little that is new or different from the British practice was learned. The 700 atm. operation at Gelsenkirchen does not increase the yield but does reduce certain difficulties of operation, for example, those due to the shortage of catalyst.

2—The Pott-Broche process, using coal tar pitch in place of extract, as carried out at Bottrop-Wilheim, operated at 140-148 atm., and this was designed to "dissolve" the coal paste in oil to produce a better hydrogenation feed stock than ordinary coal/oil paste. It was discovered, however, that the Pott-Broche product could not be hydrogenated satisfactorily. Instead it was being carbonized to produce a first-class electrode carbon, for which Germany had great need in her aluminum and steel industries.

The 700-atm. hydrogenation of coal tar pitch at Bottrop, with a novel catalyst, was successful in that it produced gasoline slightly better than the "D.H.D." process. The fuel oil which formed two-thirds of the production here was going to the tar distillery at Duisburg-Meiderich, for admixture with tar oil to make naval fuel oil.

3—The 300 atm. vapor phase hydrogenation at Scholven and Gelsenberg was found of interest. At Scholven this was followed up with the "D.H.D." process. At Gelsenberg various alternate catalysts had been tried without great suc-

1943 Production of Oil Products in Germany

The following table, from "U. S. Strategic Bombing Survey", illustrates the extent to which coal hydrogenation had taken the lead in supplying Germany's oil products, with the Fischer-Tropsch process running a poor fourth.

Source	Aviation Gasoline	Motor Fuel	Diesel Oil	Fuel Oil	Lubricants	TOTAL
Hydrogenation	1745*	386	787	135	35	3088
Crude oil	4	150	429	53	767	1403
Fischer-Tropsch	....	254	99	....	15	368
Coal tar distillation	....	34	94	820	...	948
Alcohol plants	....	18	...	...	...	18
Benzol plants	35	320	...	...	...	355
TOTAL	1784	1162	1409	1008	817	6180

* Figures given are in thousands of tons.

POLYMERIZATION

CONVERSION RECONVERSION

DURING THE WAR many polymerization plants were converted to supply cumene and codimer for the air forces.

Now that peace is here these plants can easily be reconverted to again produce civilian gasoline. In addition equipment from processes not readily adapted to civilian use may be converted to polymerization.

Universal Oil Products Co.
Chicago 4, Ill., U. S. A.

Petroleum Process Pioneers
For All Refiners

U. O. P. Service Protects Your Refinery

cess, it was learned. The 700 atm vapor phase plant at Bottrop was using a Ni-Zn catalyst, apparently developed by the Bottrop people against opposition from I. G. They made an aromatic spirit from middle oil with any "D.H.D." product.

4—The "D.H.D." operation (Dehydrierung-hoch-Druck) is a process applied to the whole of the spirit at Scholven for de-hydrogenating the naphthenes in the spirit to aromatics at 50 atm. and 500°C, using a catalyst the composition of which was determined at Ludwigshafen. The yield of aromatized petrol on petrol feed was said to be 65%. The general conclusion of the investigators was that the "D.H.D." and 700 atm. vapor phase process at Bottrop have given the Germans the aromatics they required for aviation fuel. Gelsenberg it was found, was still producing rather low quality grade of spirits.

5—Use of propane and butane: At the Scholven hydrogenation plant, isobutane was being separated and dehydrogenated in a plant which was said to be an inferior copy of the UOP dehydrogenation process. At this plant the operation used to be to polymerize butylene and hydrogenate it to isooctane. Recently an alkylation plant was put in to treat butylene and butane to make isooctane.

A. R. Powell, Koppers Co., Pittsburgh, on the grounds of the synthetic oil plant at Herten

U. S. Oil Technologists Who Investigated German Methods

Twenty-five oil technologists were included in the Technical Oil Mission which followed on the heels of the advancing Allied armies as they swept over Nazi Germany. The first of these men assembled in England last March, and were flown to their objectives even as the fighting was in progress. At last reports some of them were still overseas, continuing their investigation of Germany's research and processes in refining. Included in the group were:

John G. Allen ..... Phillips Petroleum Co.
Harold V. Atwell ..... The Texas Co.
E. L. Baldeschwieler, Standard Oil Development Co.
George S. Bays Humble Oil & Refining Co.
Leonard E. Carlsmith, Standard Oil Co. of Louisiana
Ernest Cotton ..... Gulf Oil Co.
L. P. Evans ..... Socony-Vacuum Co.
Warren F. Faragher .. Houdry Process Corp.
Vladimar Haensel, Universal Oil Products Co.
Lester L. Hirst ..... Bureau of Mines
William A. Horne, Gulf Research and Development Co.
Irvin Harvy Jones ..... Koppers Co.
Jean P. Jones ..... Phillips Petroleum Co.
Paul K. Kuhne ..... Gulf Oil Co.
Byron L. MacKusick ..... Pure Oil Co.
Louis L. Newman ..... Bureau of Mines
William W. Odell ..... Bureau of Mines
A. R. Powell ..... Koppers Co.
Hans Schindler ..... Pure Oil Co.
Guenther von Elbe ..... Bureau of Mines
Ernest F. Voss .. Humble Oil & Refining Co.
Horace M. Weir ..... Consulting Engineer
D. S. Fraser ..... PAW

The group was organized under the general direction of C. Stribling Snodgrass, Foreign Refining Director of PAW, with Dr. W. C. Schroeder of the Bureau of Mines acting as field leader.

Carbonization and Gasification

At the Lurgi plant full information was obtained about the latest development in the pressure gasification process utilized there for the complete gasification of brown coal with oxygen under 20 atm. pressure.

Details were secured of the latest design of the producer and, in particular, about the so-called "coal pocket" with inlet valves for letting in the coal in the top, which was said to be one of the difficult features to overcome. It was stated the process was completely successful with brown coal and, at the Lurgi plant, it was believed that it should work with bituminous coal, but no large scale experiments have been carried on in this direction, as far as known.

"This actual working process for complete gasification is potentially of interest in the U. S. if it can be made to work on bituminous coal" the report states.

It was learned that a low temperature carbonization process of a kind, known as the "Spul-gas" process, was being used on a large scale in the Leipzig area for the treatment of brown coal. Here the coal is briquetted before carbonization, thereby producing a saleable solid product.

The treatment of hard coal tar was also studied by the joint mission touring the Ruhr valley plants and on this point their report states:

"The most interesting feature in the great Duisburg-Meiderich tar distillery (which probably treats about half the Ruhr coke oven tar) was a new plant for continuous distillation of topped tar under a vacuum. This was claimed to give good yields of tar oil at low costs of production.

"Since no road tar was being produced during the war, the tar oil mixed with Bottrop hydrogenation oil was being used as naval fuel oil. There was also some production of flame-thrower fuel.

"Although the plant had gained some reputation for its production of rather specialized coal tar chemicals, it seemed clear that this had never been on a large scale, but small batches were made up for consumers as ordered. There was no sign of any really novel large scale development of coal tar treatment except the vacuum distillation plant."

Interlocking of Coal And Chemical Industries

Linkup of products in the field of coal processing and chemical manufacturing among the plants in the Ruhr valley was noted by the mission as follows:

1—Isobutane was being piped from the coal hydrogenation plant at Gelsenberg to the aviation gasoline units in the Scholven coal hydrogenation plant.

2—In connection with the Hüls synthetic rubber plant:

(a) Propane, ethane and ethylene were being piped from Scholven to Huls and hydrogen back to Scholven.

(b) Ethylene produced at the coke oven gas liquefaction plant at Castrop-Rauxel was being piped to the Hüls rubber plant (the hydrogen going to the neighboring synthetic ammonia plant).

3—Among the uses of Fischer-Tropsch products:

(a) By the "O.X.O." process at Sterkrade-Holten, Fischer-Tropsch olefins were to be turned via aldehydes into alcohols and eventually into soaps.

(b) Castrop-Rauxel heavy oil was going to Leuna for sulpho-chlorination into detergents.

(c) Castrop-Rauxel soft wax was going to the Deutsche Fettsaüre for oxidation to fatty acids.

4—Coal tar pitch from the tar plant at Meiderich was going to Bottrop for hydrogenation and Bottrop-Welheim oil was coming back, to be mixed with coal tar to form naval fuel oil.

Arc Cracking of Gases Yields Acetylene For Butadiene in Huls Rubber Plant

Synthetic rubber was produced by the Germans at Huls in a plant which incorporated the latest developments in design and operation. Butadiene and styrene, both made at Huls, were polymerized continuously, six reactors in series comprising each polymerization line.

Butadiene was made from acetylene, produced at Huls by the electric arc cracking of methane and/or methane-ethane mixtures. The acetylene was converted to acetaldehyde, which was in turn condensed to aldol. The aldol was hydrogenated to butylene glycol and subsequently dehydrated to butadiene.

Styrene was made by reacting benzene and ethylene in the presence of an aluminum chloride catalyst to form ethylbenzene, which was then dehydrogenated to styrene, using a zinc oxide base catalyst.

Rated capacity of the plant was 4000 tons per month. Four types of butadiene-styrene copolymer were produced—Buna S, Buna S-3, Buna SR and Buna SS, together with such byproducts as carbon black for tire manufacturing and diethylbenzene for blending with aviation gasoline base stock.

LATEST developments in the design and operation of synthetic rubber plants in Germany were found at the Chemische Werke at Hüls, controlled and operated under the direction of I. G. Farbenindustrie. Operations at this plant were reported in detail by a team of six technologists from the U. S. and one from Canada who visited the plant in April. They have issued an illustrated report of over 100 pages, entitled "Synthetic Rubber Plant, Chemische Werke-Hüls" (Index No. 189).

Among other features, this plant was supplying its butadiene from acetylene manufactured by the electric arc cracking of hydrocarbon gases. The acetylene was converted to acetaldehyde, and butadiene was produced from the latter by the so-called aldol process.

For styrene production, benzene was obtained from coal tar plants in the Ruhr, and ethylene was produced at Hüls. Butadiene and styrene were polymerized continuously in emulsion to Buna S type rubber. Four types of Buna S rubber have been produced there. Related organic chemicals including rubber softeners were also manufactured.

Capacity was 4000 Tons a Month

The Hüls plant has a rated capacity of 4000 tons per month of Buna S. Production at this rate was achieved in the early part of 1944 when operations were essentially uninterrupted by war conditions. During the latter part of 1944 and the first quarter of 1945, however, production was reduced to about 35% of rated capacity because of severe bomb damage to the nearby synthetic oil plants which supplied Hüls with its major requirements of hydrocarbon gases for acetylene manufacture. Construction was started in 1938 and the plant was put in operation in August, 1940. The plant site covers approximately ¾ square miles.

Unlike the other synthetic rubber plants in Germany, acetylene was produced at Hüls by the electric arc cracking of hydrocarbon gases (methane and/or methane-ethane mixtures). Total gas requirement for capacity operation was 130,000 to 140,000 metric tons per year.

The primary sources of the gases were two nearby coal hydrogenation plants at Gelsenkirchen and Scholven. Smaller volumes of gas were also obtained from Zeche Auguste Viktoria and from Zweckel. The gas from the former is a by-product from coke oven operations. At Zweckel there is a plant for the manufacture of ethylene oxide. For this operation, by-product coke oven gases are obtained from Scholven, the ethylene is fractionated off and the remaining saturated hydrocarbon gases delivered to Hüls.

Approximately two years earlier Hüls had contracted with the Bentheim natural gas wells to deliver up to 50,000 tons per year to the rubber plant. No gas was obtained from this source, however, until Scholven and Gelsenkirchen were unable to deliver because of bomb damage.

The *n* No. of gases from Scholven and Gelsenkirchen varied from 1.1 to 1.5 (10% ethane to 50% ethane). The *n* No. of the natural gas from Bentheim was .95 (essentially 100% methane).

There are 15 sets of arcs with mercury rectifiers for the production of acetylene (See following portion of article for details of acetylene production and purification).

From the arc reaction there is also produced carbon black, which is removed from the product gases by cyclones and water scrubbers. The yield of carbon black is 5 to 6%, which is equivalent to a monthly production of 500 tons and is shipped to tire manufacturers. Acetylene is removed from the reaction gases by absorption in water at 18 atmospheres and is then stripped off at 96-97% purity. Some ethylene is also produced from the arc reaction, the yield of ethylene increasing with an increase in the number of the feed gases.

Low Temperature Distillation Used

Ethylene, hydrogen and unreacted methane and ethane are separated from each other by low temperature distillation (Linde plant). The hydrogen required for the hydrogenation of aldol to butylene glycol in the butadiene process is purified by low temperature distillation (—180°C.) using liquid nitrogen as reflux. By this operation it was found possible to obtain hydrogen with a CO content of less than .0001.

Process nitrogen for blanketing is obtained by liquefaction of air. The liquid oxygen was shipped to the steel plants in the Ruhr area for welding. During the last year of operation, Hüls supplied the Scholven and Gelsenkirchen plants with nitrogen as their Linde plant had been destroyed by bombing.

Ethylene requirements are supplied from four sources as follows: by-product from the electric arc, hydrogenation of acetylene, dehydration of ethyl alcohol, and coke oven separation at the Zeche Auguste Victoria.

The major portion of ethylene is produced by the hydrogenation of acetylene, using palladium on silica gel as catalyst, a reaction temperature of 200°C. and 100% excess hydrogen. Ethane and butane are by-products in small quantity (5 to 10%). Six hundred tons of ethylene per month were produced by this process and used primarily for the ethylation of benzene in the styrene operations.

Alcohol Also Yielded Ethylene

Large quantities of ethylene are also manufactured by the dehydration of ethyl alcohol (potato) using CaO as catalyst. However, because of inadequate distillation equipment for the removal of by-product ethers, the ethylene could not be used for benzene ethylation, but was suitable for the manufacture of ethylene oxide.

Acetylene is converted to acetaldehyde by passing the gas up through a mercury-

sulfuric acid catalyst in the presence of ferric sulfate.

Butadiene is manufactured from acetaldehyde by using the so-called aldol process. Acetaldehyde is condensed to aldol in the presence of KOH. Aldol is hydrogenated to butylene glycol at 300 and 700 atmospheres over a chromium activated copper catalyst. Butylene glycol is dehydrated to butadiene at 280° C. using a phosphate catalyst deposited on coke.

The yield on the dehydration step is 82% of theory and the yield from acetaldehyde is 65%. (See Table 1). Utilized by-products from the butadiene process are: crotonaldehyde, butanol, ethanol, 2-ethyl hexanol and hexantriol. The hexantriol was sold to lacquer manufacturers, where it is condensed with phthalic anhydride for use as a glyptol type resin.

The styrene process is a two-step operation. Ethylene and purified benzene are reacted at 90° C. in the presence of $AlCl_3$ catalyst to form ethylbenzene and the latter is dehydrogenated in the presence of steam to styrene at 600° C. using a zinc oxide base catalyst. Some diethylbenzene was shipped out for use in aviation gasoline base stocks. The still bottom residue from the ethylbenzene distillation boiling higher than hexaethylbenzene was sold as Plasticator R. A., a softener used in tire manufacture.

Butadiene and styrene are polymerized in emulsion continuously, with each line consisting of six reactors in series. Hüls was the only synthetic rubber plant in Germany to produce all four types of Buna S rubber used on a commercial scale; Buna S, Buna S-3, Buna SR and Buna SS.

Buna S was the original butadiene-styrene rubber in which linoleic acid was used as a polymerization regulator. However, because of critical shortage of linseed oil which developed during the early part of 1944, it was necessary to switch to the manufacture of Buna S-3, which used di-isopropylxanthagen disulfide as the regulator. Buna SR is a 50-50 mixture of Buna S and Buna R, the latter being a high conversion Buna S carried out at high temperature during the last stage of the polymerization. Buna SS is the high styrene content rubber used for extruded articles because of its easy processing.

The power plant at Hüls has a rated capacity of 125,000 KW, and a maximum capacity of 175,000 KW. It is said to represent the most modern power plant design in Germany. High pressure steam at 125 atmospheres is produced. Low pressure steam from the primary turbines, and condensate from the secondary turbines are available for chemical processing.

TABLE 1

Summary of Yields in Processing Steps at the German Synthetic Rubber Plant at Hüls, as Derived from 1944 Actual Plant Records

	Yield %
Styrene Manufacture	
Ethylene to ethylbenzene, and Benzene to ethylbenzene	94.5
Ethylbenzene to styrene	90.2
Over-all benzene to styrene	85
Butadiene Manufacture	
Acetylene to acetaldehyde	91.7
Acetaldehyde to aldol	99.1*
Aldol to 1,3-butylene glycol	98.9*
Butylene glycol purification	81.9*
Butylene glycol to butadiene	80.6
Over-all acetylene to butadiene	60
Over-all acetaldehyde to butadiene	65

*These figures are rather meaningless except as a whole, since the intermediate products are not given.

Acetylene Production by Electric Arc Cracking, and Its Purification

From TIIC Report, "Synthetic Rubber Plant, Chemische Werke—Huls" (Index No. 189)

Natural gas (methane) or by-product gases from coal hydrogenation (methane-ethane mixture) are converted to acetylene for butadiene manufacture by passing them through an electric arc. Both electrodes are copper, and direct current at 7000 volts is used. Feed stock consists of one part fresh gas and one part recycle, with 50% conversion per pass. In addition to 97-98% pure acetylene, products include ethylene, carbon black, hydrogen and carbon monoxide.

ACETYLENE is produced at the Huls synthetic rubber plant, for source material for butadiene, by the electric arc cracking of hydrocarbon gases, using direct current at 7000 volts. The installation has 15 reactor sets, each set consisting of one mercury arc rectifier for converting alternating to direct current, and two arc-reaction units. Only one arc-reaction tube unit is on stream at a time, the other being held as a standby. For rated plant capacity, 12 to 14 reactor sets were in continuous operation.

In the arc-reaction tube unit, the high voltage lead to the primary electrode enters at the top. This electrode, made of copper, is jacketed for water cooling during operation and insulated with porcelain. Feed gases enter tangentially, circulating around in an annular space in the expanded head section of the unit, and pass through vertical slots to the arc zone at the center and down into the reaction tube.

This produces a high velocity swirling action to the gases and thereby eliminates burning out the electrode and carbon deposition. The second electrode consists of a copper gasket at the head of the reaction tube and is grounded.

For starting up the arc there is an auxiliary electrode which operates by compressed air. In starting position, this electrode is up against the primary electrode. On formation of the spark, the expansion of the gases throws the auxiliary electrode back out of position and simultaneously breaks its electric contact.

The reaction tube is made of mild carbon steel and is jacketed for water cooling. It is 1 meter long, 9.5 cm. inside diameter and has a wall thickness of 9.0 mm. The tube life is approximately 240 hours and is replaced when burned out. A water spray enters into an expanded section just below the bottom of the reaction tube and immediately quenches the reaction gases.

The arc will operate with methane (Bentheim natural gas) or methane-ethane mixtures (by-product from coal hydrogenation) as feed. The feed to the arc consists of approximately one part by volume of fresh gas and one part recycle. Each arc unit handles 2800 m^3/hr of feed which is expanded to 4200 m^3/hr during reaction. Operation of the arc is at 1.5 atm. absolute. The terminal temperature in the reaction tube is 1600°C. The reaction gases are then immediately quenched by a water spray (four m^3/hr.) to 150°C. The primary electrode is jacket cooled with eight m^3/hr of water and the reaction tube with nine m^3/hr.

Typical volumetric analyses for the arc inlet and outlet gases with both types of feed are shown in Table 2.

Conversion per pass through the arc is approximately 50%. In a typical material balance around the arc system, using by-product gases from coal hydrogenation and feeding one part of fresh gas and one part of recycle, for 100 kg. of fresh gas there are obtained 45 kg. acetylene, 9.2 kg. ethylene, 5.3 kg. carbon black and 143 m^3 hydrogen.

Referring to Table 2, it is calculated that for the same volume feed there is produced 606 m^3 acetylene and 61 m^3 ethylene from refinery gas, and 516 m^3 acetylene and 3 m^3 ethylene from natural gas. As the power consumption was indicated to be essentially independent of the feed type at constant volume throughput, it would appear that, as the *n* number of the feed gas increases, the net production of both acetylene and ethylene increases per unit power consumption. The *n* number of the refinery gases varied from 1.1 to 1.5 and for natural gas it averaged 0.95.

For a gas feed to the arc of 2800 m^3/hr. and a resultant output of 4200 m^3/hr. the

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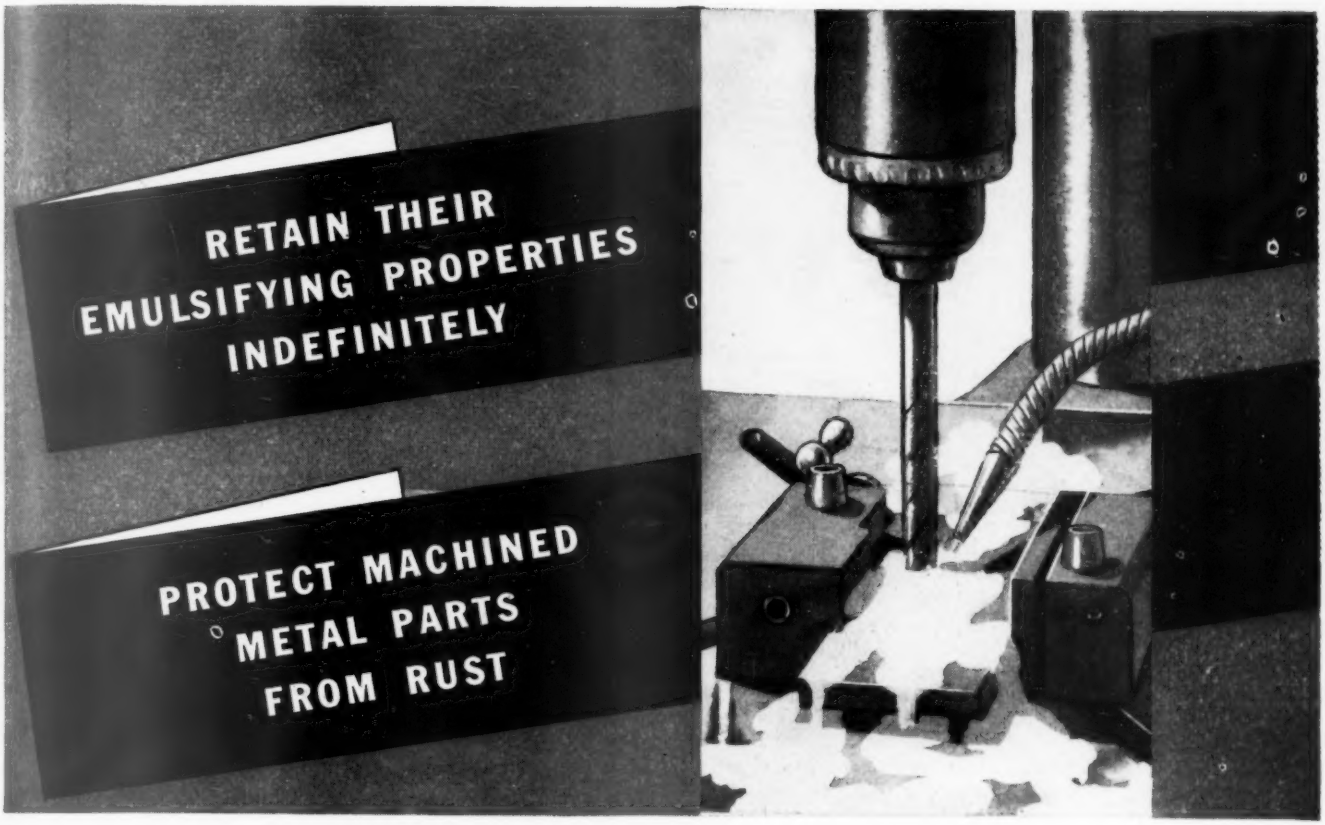

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Total Rubber Production in Germany (Metric Tons)

Location	1938	1939	1940	1941	1942	1943	1944
Buna S Types							
Schkopau	3,994	20,173	34,899	40,705	57,313	67,703	45,113
Hüls	.....	.....	2,045	25,020	36,680	34,693	39,105
Ludwigshafen	.....	.....	.....	.....	.....	7,181	11,955
Leverkusen	(‡)	403	193	164	173	992	°1,320
Total Buna S	3,994	20,576	37,137	65,889	94,166	110,569	97,493
Buna N Types							
Leverkusen	†640	1,126	1,898	2,631	2,824	3,656	°3,129
Hüls	.....	.....	.....	.....	.....	.....	43
Total Buna N	640	1,126	1,898	2,631	2,824	3,656	3,172
Numbered Bunas							
Schkopau	848	649	1,431	1,955	2,721	3,388	2,590
Grand Total Synthetics	5,482	22,351	40,466	70,475	99,711	117,613	103,255

°To Oct. 26, 1944. †Approximate. ‡Not available.

power requirement averaged 7000 KW. Referring again to Table 2, it is calculated that the power consumption in the arc per kg. of acetylene produced is 9.93 KWH for refinery gas and 11.6 KWH for natural gas. This compares to 9.5 to 11.0 KWH per kg. of acetylene by the carbide process using a figure for power consumption of 3.1 to 3.3. KWH per kg. of carbide and a carbide requirement of 3.00 to 3.25 kg. per kg. of acetylene. These data are for actual conversion only and do not include auxiliary power for pumping, compression etc. which probably is higher for the arc process because of the involved purification system required.

After quenching the exit gas from the reaction tube to 150°C. (dew point 92°C.) it is sent to two cyclones in series, in which 60 to 70% of the total carbon black is knocked down. The gas is sprayed with water in a wash tower to knock down most of the remaining carbon black, and then passes through bag filters to remove the residual black. The bag filters are heated to prevent condensation. Most of the water carried in the gas is next removed by spray cooling with water at 20-25°C., bringing the temperature of the gas below the dew point.

Higher boiling constituents in the gas are removed by counter current washing with an aliphatic oil in a series of towers. The rich oil is stripped under 600 mm. vacuum and recirculated. The gas from the oil washers is washed with water to remove HCN and then passed through the iron oxide boxes to remove sulfur.

After this preliminary purification, the gas is compressed to 19 atm. and absorbed in water in perforated plate towers. The non-absorbed gases, consisting primarily of methane, ethane, ethylene and hydrogen, are passed to the Linde plant, where ethylene and hydrogen are separated out and the paraffins are returned to the arc.

Acetylene is stripped from the water by four-stage flashing to a final pressure of .05 atm. absolute. As the gas from the first stage is too low in acetylene (45%), it is recompressed and recycled through the absorber. The gas from the second, third and fourth flashers is brought together as crude acetylene of 90% purity and is further purified. Water from the last flasher is blown with residue gas from the Linde plant to remove last traces of hydrocarbon gases, which then can be returned as feed to the arc and the water is sent to a cooling tower.

The crude acetylene is brought up to 97% concentration, with 1% of CO_2 and 2% inerts as impurities, by a system of (1) low temperature condensation and evaporation using liquid ammonia and (2) scrubbing with a petroleum distillate. This system removes the higher acetylenes (methyl acetylene, vinyl acetylene, diacetylene, etc.). CO_2 is removed by scrubbing the acetylene with caustic solution, giving a final purity of 97-98%.

Hüls is equipped with a complete low temperature separation system for gases in order to prepare recycle gas for the arc system and separate ethylene, hydrogen, carbon monoxide, nitrogen and oxygen for use in the plant. Air is compressed to 130 atm. and separated into nitrogen and oxygen by low temperature fractionation.

Non-absorbed gases from the acetylene water absorber, consisting of methane, ethane, hydrogen and ethylene and by-product coke oven gas for use as feed to the arc, are separated into their components in low temperature distillation equipment using nitrogen at 200 atm. for cooling.

Methane and ethane separated as a single fraction are sent to the arc for cracking. Hydrogen and carbon monoxide are fractionated off, and crude ethylene at a concentration of 15-25% is compressed to 30 atmospheres and purified to 95%, which is then suitable for ethylbenzene manufacture. Ethylene from hydrogenation of acetylene is also purified in this unit. The hydrogenation of the acetylene is carried out at 200°C. using palladium on silica gel as catalyst and 100% excess oxygen.

TABLE 2—Typical Volumetric Analyses for Arc Inlet and Outlet Gases.

	Refinery Gases°		Natural Gas	
	Inlet Gas	Outlet Gas	Inlet Gas	Outlet Gas
CO_2	0.2	0.0	0.3	0.0
C_2H_2	2.7	16.2	1.5	13.3
Olefins	3.2	3.6	1.4	0.9
O_2	0.2	0.2	0.3	0.2
CO	1.4	1.0	3.0	2.9
H_2	10.9	50.5	2.5	46.0
CH_4 & hom	74.5	25.1	80.2	27.8
N_2	6.9	3.4	10.8	8.9
	100.0	100.0	100.0	100.0
Impurities in gm/m³				
HCN	1-3		2-5	
Naphthalene	1-3		0.12-2.0	
Benzol	1-6		1.5-8.8	
Diacetylene	15-30		15-30	
H_2S	trace		trace	
Carbon Black	20-25		11	

° By-product gases from coal hydrogenation for synthetic petroleum.

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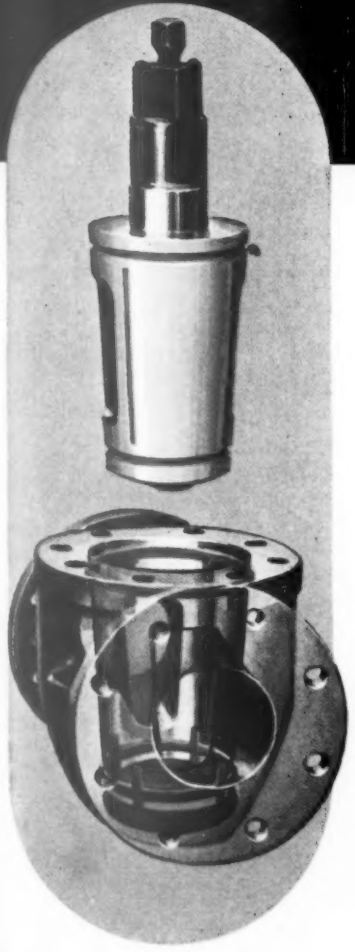

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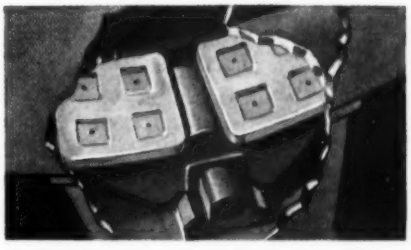

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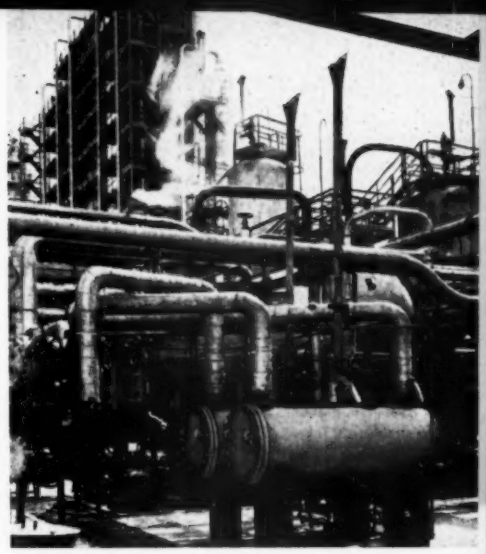


These two separators are used to remove water from the isobutane feed stock for an alkylation unit. By taking out 70% of the total water content in the isobutane they are saving the equivalent of 5 tons of sulfuric acid catalyst each day

IN MANY refinery processes the question of water contamination in feed stocks often is an expensive one when the problem of removing it is concerned. Its presence frequently requires an excess of some treating reagent over that otherwise required.

A case in point is the technical report of a large oil company, which gives experience with a commercial separator removing water from an isobutane stream before further processing. A saving of 5 tons daily of 98% sulfuric acid in an alkylation unit using it as catalyst was effected by removing 70% of the total water content. The following paragraphs are taken from the report, dated September, 1944, but previously withheld from publication.

Report on Separator

In a sulfuric acid alkylation plant, one of the factors affecting acid consumption is the amount of water entering in the feed stocks. Heretofore, conventional settlers have not been particularly attractive for this service because of the equipment costs for removing the relatively small amount of suspended water present.

A water coagulating unit of low cost and high capacity now is available, however, which will remove undissolved water from butane or light naphtha streams. About six months ago one of these units was placed in service on the isobutane charged to a sulfuric acid alkylation reactor. The performance of this drier has been followed rather closely since such information is of general interest in considering other installations elsewhere.

Removes Suspended Water from Isobutane

Data obtained during the first 40 days of operation indicate that the unit effectively removed a large portion of the suspended water present in the isobutane stream. Based on the daily measurements, an average of 1130 lbs. per day of water is being removed from the isobutane stream, which is equivalent to a 98% fresh acid saving of about 5 tons per day. However, since the plant is operated to consume the maximum amount of fresh acid available from the supplier, the drier has increased the output of pentylene alkylate. The drier throughput has averaged about 150% of the capacity rating. On the basis of the performance of this unit, two additional driers are being installed on other butane streams entering the alkylation plant.

The recycle isobutane from light ends fractionators to the alkylation plant is saturated with water at the reflux accumulator temperature due to presence of a small amount of water in the feed stocks to these towers. The isobutane streams are cooled about 60 to 70°F below the reflux accumulator temperatures by heat exchange before entering the reactor, and the separate water phase formed at the reduced water solubility level can be coalesced with the drier. Measurements were made on the water rate from the drier, and several attempts were made to check the efficiency of the drier by analysis of the inlet and outlet butane stream. However, difficulty in obtaining a representative sample and in making a water analysis resulted in the measured and calculated removal rates not agreeing particularly well.

Maker Claims 99.8% Water Removal

It was found that the analyzed water content in the exit butane was somewhat higher than that predicted for the solu-

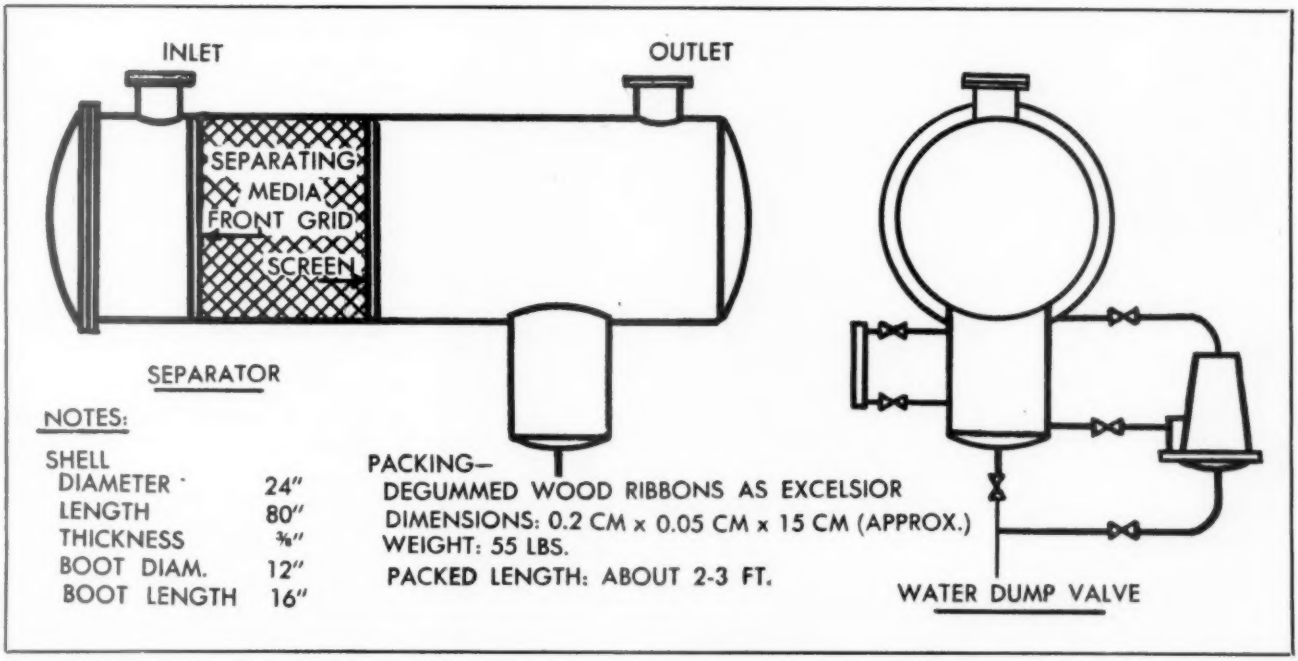


Fig. 1—Details of separator and water dump valve

bility of water in butane to indicate a removal efficiency of about 70—80%. Typical data are shown in Table 1. It is concluded that the unit was removing the suspended water at a reasonable efficiency even though operated at 150% of the designed throughput, but measurements and analyses were not sufficiently precise to substantiate the manufacturer's claim of 99.8% of the removal of undissolved water.

In the figure, details of the "Excel-So" separators are shown.* This unit (Fig. 1) was purchased from the Warner-Lewis Co.** of Tulsa, Okla. at a cost of about $600, which included $60 for a water trap, $30 for three packing units, and $510 for the shell. Examination of the unit revealed the coagulating medium is wood shavings in the form of excelsior. According to the manufacturer, the shavings are specially treated (degummed) to avoid contaminating the hydrocarbon and to coalesce water droplets emulsified in the oil. The excelsior cartridges are reported to suffer no deterioration from continued use and a change of packing apparently is required only when the pressure drop across the bed becomes prohibitive. The unit purchased for drying isobutane to the reactor is rated at 300 gpm, but it has been possible to process 450 gpm with a pressure drop of only 10 psig. The unit has been in operation about six months and four new cartridges have been used on account of excessive pressure drop.

*Further description of this separator will be found in the TECHNICAL SECTION for April 5, 1944, pg. R-232.

**Agent for Flotrol Systems, New York City.

TABLE 1—Typical Performance Data on Isobutane Drier

	March 11	March 13	March 14
Drier Temperature, °F.	65	80	71
Butane Rate, gph	27,600	26,100	28,200
Butane Rate, % rated capacity	153.3	144.9	156.7
Solubility, lb. water/100 lb. butane*	0.0059	0.0100	0.0072
Butane In, lb. water/100 lb. butane	0.0467	0.0357	0.0524
Butane Out, lb. water/100 lb. butane	0.0144	0.0188	0.0200
Calculated Water Removal, from analysis, lb./hr.	43.6	21.2	43.4
Measured Water Removal, lb./hr.	36.4	41.3	32.0
Removal Efficiency, %	79.3	65.8	71.8

* Predicted from Solubility Data reported in TAC–H_eCL–2.

TABLE 2—Recast of Separator Data In Table 1

	March 11	March 14	March 13
Butane Temp., °F	65	71	80
Butane Specific Gravity*	0.586	0.570	0.576
Dissolved water, % vol.	.00346	.00410	.00576
Input, total water, % vol.	.0274	.0299	.0206
Output, total water, % vol.	.00844	.01140	.01084
Input, undissolved water, % vol.	.0239	.0258	.0148
Output, undissolved water, % vol.	.00498	.00730	.00508
Calc. undissolved water input, gal/hr	6.61	7.28	3.87
Calc. undissolved water removed, gal/hr	5.24	5.22	2.55
Calc. undissolved water, % removed	79.2	71.7	65.8
Actual water drain, gal/hr	4.37	3.84	4.95
Flow Rate—GPM	460	470	435

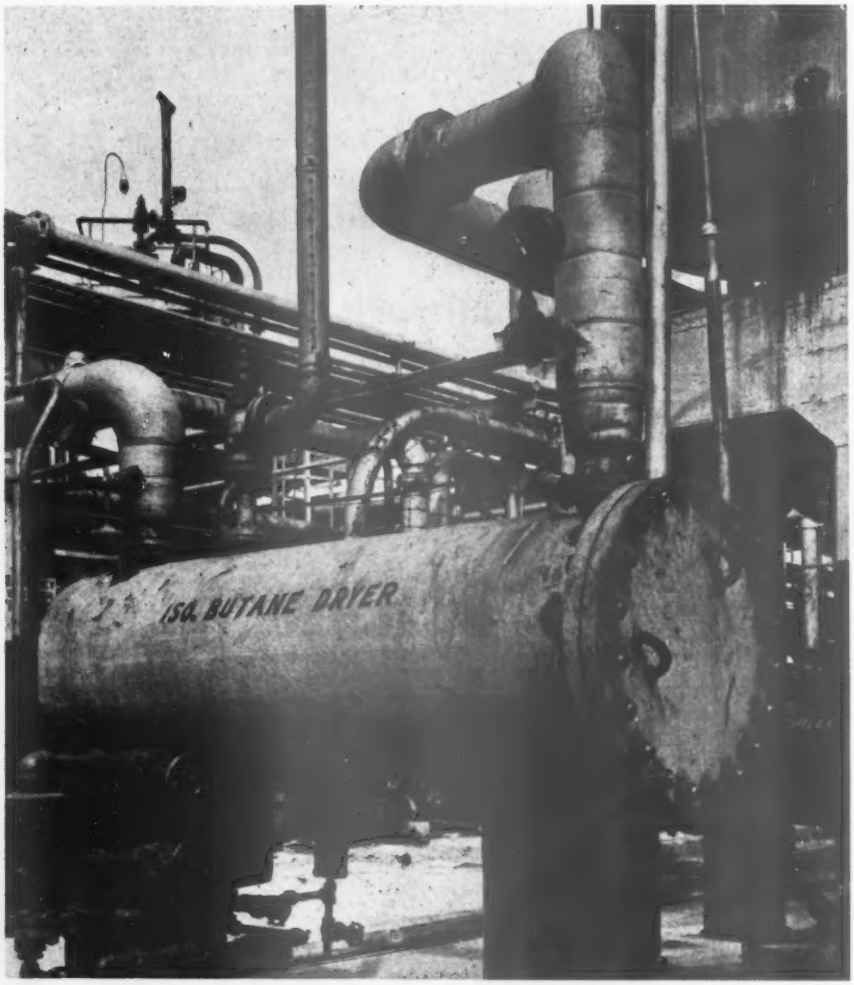
* Butane specific gravity calculated as follows from original data (65°F. Run): [43.6/(.000467 – .000144)] x 1/27600 x 1/8.34 = 0.586.

Butane Is 99.995% Water-Free

The data in the oil-company report have been recast as shown in Table 2 by a research engineer engaged in independent competitive test rating of separators. He points out that the separator was delivering butane with an undissolved water content of 0.00498 to 0.00730% by volume, or 99.993—99.995% water-free, despite being operated at a flow-rate exceeding design capacity and too great for its settling-chamber size.

Theoretically, the unit should handle (1—0.58/1—0.68) x 300 or 395 gpm. based on the lower specific gravity of the isobutane and the unit's being design-rated for gasoline.

The engineer's comment also brings out discrepancies in the original data for the run of March 13 wherein the observed water-drain rate is larger than the calculated rate since undissolved water entered the unit at 3.87 gpm but actual drain was 4.95 gpm. He states the possibilities are "(a) a mistake in measurement, (b) measurement made during a non-equilibrium condition, or (c) that the unit removed dissolved as well as undissolved water."



Close up of one of the separators. The isobutane is charged through the line at the right, passes through an excelsior packing contained in the separator, and leaves through the line at the left—minus 70% of its original water content. The water, which coalesces on the packing, drops to the bottom of the separator and is withdrawn through a dump valve

No. 2 in a Series

Sulfur and Sulfur Chloride Organic Reaction Products As 'Lube' Oil Additives

By George G. Pritzker

U. S. Patent Examiner

Recognizing the ever-increasing importance of lubricating oil additives in the refining industry, NPN's editors have arranged with George G. Pritzker, Chemical Engineer and U. S. Patent examiner, to prepare this series of articles reviewing the patent literature on various phases of the subject. The series is appearing exclusively in the Technical Section.

Mr. Pritzker first became interested in the lubricating art over 8 years ago, while employed by the Freeman Chemical Co. in their grease department. He is a graduate of Brooklyn Polytechnic Institute and has been with the Patent Office (Div. 64, Richmond, Va.) since 1942.

Two factors have aided the development of the sulfur or sulfur-chloride type of products as lubricating oil additives; first, their low cost and ease of preparation and, second, their serviceability in combination with lead soaps in the preparation of extreme pressure lubricants. A review of the patent history discloses numerous organic compounds and methods of reacting them with sulfur or sulfur chloride to produce desirable potent sulfurized addition agents.

This is the second article by this author on the subject of lubrication oil addition agents appearing exclusively in the NPN Technical Section. The first, on Sulfonic Derivatives, appeared in the Oct. 3d issue; the third and concluding article, on phosphorous Sulfide-Organic Reaction Products, will appear in the Dec. 5th issue.

Tracing the patent literature on the use of sulfur or sulfur chloride organic reaction products as lubricating oil improving agents, two dominant factors are brought out. First, such reaction products are low cost, easy to prepare and are excellent substitution products for fatty materials such as lard oil in the metal cutting and work lubrication art. Second, with the development of hypoid gears and various alloyed bearings, as well as improved engine design, lubricants capable of withstanding high temperatures and extreme pressures were necessary.

One of the earliest groups of the latter type of additives was lead soaps such as lead oleate. However, after careful study it was noticed that lead soaps alone were unsuitable as extreme pressure agents, but in the presence of small amounts of sulfur or sulfur chloride reaction organic products, excellent extreme pressure lubricating oil additives were obtained. Careful observation has disclosed that sulfur containing compounds act as activators for lead soaps in mineral lubricating oils and enhance their extreme pressure properties.

In addition to the two interesting points mentioned above, sulfur and sulfur chloride reaction products have been found to possess many more desirable lubricating properties, and lubricants containing sulfur additives are used to lubricate various engines and machines.

Early Disclosures

One of the earliest disclosures on the use of sulfur as an additive ingredient in lubricating compositions is made in the Kestler patent;[1] Kestler obtained an improved lubricant for machinery and axles by heating residuum from the distillation of coal-oil or from crude petroleum with saleratus or sal-soda or their mixtures and brimstone. The base was cooled and filtered, and desired amounts of kerosine were added to produce an improved sulfur containing lubricant.

About 1888, Sommer[2] treated various fatty materials with sulfur chloride and neutralized the reaction to obtain additives for cutting lubricants.

Since that time, lubricating engineers have been working continuously on methods of producing sulfur and sulfur chloride reaction products with various hydrocarbon distillates, fatty materials, organic compounds, and synthetic materials, in order to obtain improved, stable, and potent lubricating oil additives.

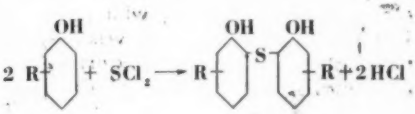
The reaction of sulfur or sulfur chloride with some materials is complex: Many side reactions take place, and at present the reactions are not entirely understood. With unsaturated compounds at temperatures above the melting point of sulfur, it is believed that sulfur attaches itself at points of unsaturation in the following manner:

$$RCH=CHR+2S\rightarrow R-\underset{|\_\_\_\_|}{CHS-SCH}-R$$

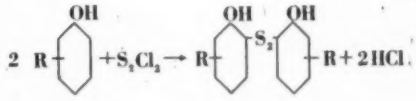
Sulfur chlorides, on the other hand, when reacted with unsaturated materials, react in such a manner that both sulfur and chloride enter the unsaturated bonds.

$$=C=C=+S_2Cl_2\rightarrow$$
$$=CCl-(C=)-S-(C=)-CCl=+S$$

Even sulfur monochloride and sulfur dichloride, two very closely related materials, when reacted with some organic materials, give different reactions. Thus, when phenols in a suitable solvent, such as CCl_4, are reacted with sulfur dichloride, a monosulfide is produced:



while with sulfur monochloride a disulfide is produced:



In cases where it makes little difference in the resulting end product, it is advisable to use sulfur as the reacting agent because of its ease in handling, availability, cheapness, and reactivity with almost all organic materials. Sulfur chlorides, on the other hand, are difficult to handle but have the advantage over sulfur in that lower temperatures and shorter periods of time are required to complete reactions.

The introduction of sulfur or sulfur chlorides into hydrocarbon distillates, fatty materials, organic compounds, and organic synthetic materials is rather simple, for these materials are very reactive. However, to produce a stable, non-corrosive, oxidation-resistant, and non-sludging lubricating oil additive of the sulfur or sulfur chloride-organic material type is a difficult and complex problem.

Sulfurization of organic materials usually produces dark, complex reaction materials, which are corrosive, unstable, form sludge, and are foul smelling. The goal of the lubricating engineer has been to react sulfur or sulfur chloride with organic materials in which these undesirable characteristics are absent, and to produce a sulfurized lubricating oil additive which is clear and transparent, stable, non-corrosive, resists oxidation and sludge formation, and possesses oili-

ness, film strength, and extreme pressure properties.

Patent History Reviewed

The following review will disclose numerous organic compounds and methods of reacting them with sulfur or sulfur chloride in order to produce desirable potent sulfurized lubricating oil additives.

In 1872, a British patent[8] disclosed that vegetable and mineral oils suitable for lubrication purposes could be improved, especially against oxidation by sulfurizing these oils with from 5 to 10 parts of sulfur at 270-290° F. In 1883, a U. S. patent was issued to Woodbury[4] for an improved lubricant for journals, comprised of talc, tallow, lard, and sulfur.

In order to obtain a superior cutting oil lubricant, Bezzenberger[5] sulfurized unsaturated oils, such as soybean, linseed, China-wood, corn, cottonseed, rapeseed, as well as menhaden fish oils, lard oils, and neat's foot oil, with sulfur at 140-150° C. Sulphurization was not carried out to completion because completely sulfurized products of this type are not soluble in animal and mineral oils. The sulfurized base oil was stirred into a mixture of one part lard oil and four to five parts mineral oil at 100-120° C, producing a chemically stable, clear lubricant.

A lubricant for roller mill and railway car bearings running at high temperatures was obtained by Beck[6] by reacting stearic acid, tallow, linseed oil, or soy bean oil, either alone or admixed with resin, with 5-25% sulfur and preferably 10-15% sulfur at 430-460° F. or higher, until a chemical reaction took place. The sulfurized base was mixed with a lubricating oil, and modifying agents, such as petrolatum, graphite, or lampblack, were added to produce the finished product.

Lard Oil Substitutes

Lard oil and lard oil products for years have been the main ingredient in cutting compositions. However, because of their high cost and tendency to turn rancid and decompose, their useful characteristics have been partly offset and a never ending search for a substitute possessing all the useful qualities of lard oil and free from its undesirable characteristics has been carried on by the lubricating engineer. With this goal in mind, Oldacre[7] found a substitute for lard oil in cutting compositions by heating mineral oils, such as paraffin oil, red engine oil, neutral oil, etc., with sulfur chloride at about 170° F. until sulfur was in stable, chemical combination and had a low cold test. Gases evolved during the reaction were removed by neutralization or by blowing with air. When about 7% sulfur chloride was used in the reaction, about 3½% sulfur by weight was present in the end product.

Johnson[8] formed a soluble oil lubricant by dissolving a water-soluble sodium sulfonate in a non-mineral oleaginous vehicle, part of which, if desired, could be substituted with mineral oil cooked with 0.5-3% sulfur until the sulfur was firmly combined.

Marble[9] obtained a cutting oil by heating sulfur to about 350° F, adding soda, borax, and vinegar, and heating until a thin liquid was obtained. The sulfur containing mixture was admixed with a suitable amount of lard oil.

Becker[10] reacted special fractions of distilled residuum obtained from cracked hydrocarbon oils by pressure distillation with 1 to 5% sulfur at 400-500° F until the sulfur is dissolved. The sulfurized product was blended with a desired lubricating oil to obtain an improved lubricant.

Taking an initially high sulfur containing hydrocarbon oil, say in excess of 0.75%, Adams[11] subjected it to sulfurization with sulfur in excess of 3% at a temperature of 300-350° F and obtained an improved cutting oil base. In a very interesting article by Boston and Zimmer in *Lube Text*, entitled, "A Study of Cutting Oils With and Without Added Sulfur," it is disclosed that high sulfur containing mineral oils are of no value as cutting oils, although when such oils are sulfurized the sulfur in the oil does play some role in combining the added sulfur in the mineral oil.

Departing from the sulfurization of mineral oils for use in cutting lubricants, Kobbe[12] reacted terpenes, such as pine oil, turpentine, pinene, terpineol, and polymerized pine oil, with sulfur at 178-210° C and not in excess of 250° C until a homogeneous mixture containing 1 to 3% sulfur was obtained. The sulfurized product was incorporated in mineral oil or materials having lubricating properties.

Controversial Issue

Much controversy exists even to this day as to whether the most effective results are obtained when sulfur is present in the free state and suspended state in a lubricating medium, or whether it should be in a chemically combined form in order to obtain improved oil additives. Some believe that free sulfur held in suspension in an oil may act as an abrasive and increase tool wear, while others think that free sulfur has a beneficial effect when present in oils, in that it conducts away heat and thus produces a marked cooling effect. Abrams[13], however, discloses that free sulfur serves as a superior cutting lubricant, owing to the fact that at high temperatures it is present as a viscous liquid which acts as a lubricant between frictional surfaces. The composition prepared by Abrams comprised a blown starch-water mixture to which 5-25% sulfur was added. Instead of starch, glue, dextrin, casein, etc., can be added. To prevent rusting when in the presence of iron or steel, mineral oil was added to the sulfur containing mixture and 1 to 15% soap, to increase the wetting of the surface lubricated.

To obtain an improved oil base, Palmer[14] prepared a cutting oil base by combining sulfur with terpene oils without dehydrating the tertiary alcohols present in the terpene oils. The terpene oils and sulfur were refluxed in the presence of a small amount of alkali or base forming substance which will chemically combine with the H_2S produced during the reaction to form basic compounds. The basic compound so formed acts to protect the tertiary alcohols from the dehydrating action that might otherwise result from the acidity of the reaction products present in the mass at any given time. If the reaction is carried out in the presence of an oxidation catalyst, a saving in sulfur is effected, as the H_2S formed reverts to sulfur during the reaction.

Sulfurization Under Pressure

Nelson,[15] in order to obtain an improved composition for drilling, thread cutting, and similar lathe machine work, having marked cooling effect on the work piece and which alleviated friction between contacting parts, sulfurized an oil under superatmospheric pressure. The sulfurization was carried out at 300° F (350-450° F) and the H_2S formed either combined with or remained dissolved in the oil after the pressure was released. The odor of the H_2S was removed from the final product either by blowing or by addition of pine tar, which destroyed the odor. The product had a sulfur content of from 4 to 10% and, when added to a suitable cutting oil, increased its viscosity, and improved its oiliness and emulsifying properties.

Gallsworthy[16] also sulfurized an oil under pressure but, instead of using only sulfur in the reaction, he utilized both sulfur and sulfur chloride. The sulfur containing oil was obtained by reacting a mineral oil with 1-3% sulfur at 250° F. and then adding 1-5% sulfur chloride under pressure in order to prevent loss of sulfur in the form of gases such as H_2S.

To obtain a sulfur oil base in which the sulfur is in combined form, Gallsworthy[17] mixed lubricating oil with oxidized paraffin wax and reacted the mixture with sulfur at 380-400° F.

Since sulfur containing materials have produced such beneficial results in cutting compositions, attempts have been made to use such products in the lubricating of hypoid gears and the like where extremely high temperatures and pressures are encountered. However, Farrington[18] disclosed that lubricants containing sulfur in elemental or uncombined form are unsuited to such purposes because of their undue corrosiveness which results in deterioration

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of metal parts and shortens the life of the lubricant.

The utilization of superatmospheric pressure in sulfurization as mentioned in the Nelson [19] and Gallsworthy[20] patents above, is also shown in the Kaufman patent;[21] but Kaufman sulfurizes terpenes instead of mineral oils. Such terpenes as terpineols, pine tars, etc., were reacted with 5-30% sulfur at temperatures of from 300-500° F. under superatmospheric pressures in order to obtain a sludge free, light colored product having extreme pressure properties and suitable as a cutting oil base. Kaufman[22] also disclosed that above product could be subjected to distillation and the residuum, which contains about 24% of the charge and a sulfur content of about 30%, used as a cutting oil base.

Product Acid Treated

To improve the film strength, color and stickiness of a sulfur treated mineral oil at temperatures of 300° F. (400-600° F) under pressure, Nelson[23] acid treated the sulfurized product. Pine oil was added to improve the odor of the products and to stabilize it against sludge formation.

Lubricants for pipe threads and the like which prevent seizing, galling, and stripping were prepared by Smith[24] and comprised mixtures of petrolatum or metallic soap grease, lubricating metallic powder, such as zinc or aluminum, and an extreme pressure agent, such as chlorinated hydrocarbon, sulfurized compound, or sulfur itself. A typical combination consisted of mineral oil, calcium tallow oil soap, zinc powder, sulfurized sperm oil, and colloidal graphite. The sulfurized sperm oil or lard oil was obtained by reacting these oils with 5 to 30% sulfur at 300-385° F.

Abrams[25] obtained a novel high pressure, high temperature oil additive by reacting with sulfur chloride tung, corn, linseed oils and their mixtures, purifying the reaction product and then crushing to a powder and grinding in an oil. The jell-like particles obtained were dispersed in a suitable lubricating medium.

A sulfurized base product suitable for hypoid gear lubrication was obtained by Forney[26] by reacting polymerized hydrocarbon containing polymerized aromatic constituents with H_2S at 375-450° F until the sulfur combined with the hydrocarbon material. The product so obtained was light, possessed a high degree of fluidity, and had none of the offensive odor which is common with products made from polymers and sulfur.

In order to obtain an extreme pressure lubricant, Morway[27] cooked cracked wax, vegetable, mineral, and marine oils with sulfur or sulfur chloride so that the sulfur remained in corrosive form, and added the sulfur rich material to an oil-soluble zinc salt or soap of high molecular weight organic acids, such as oleic or stearic acids.

Reacted Cracked Distillates

A product superior to lard oil as a cutting oil lubricant was obtained by Muskat[28] by reacting cracked distillates with 15-40% sulfur at moderate temperatures of 200-350° F until the sulfur dissolved. The unsulfurized fractions were distilled off, leaving a sulfurized stable hydrocarbon residue, which was used as the base lubricant.

A lubricant non-corrosive to "soft metal bearings" was prepared by Lincoln[29] by reacting with elemental sulfur at 360-390° F mono and dihydric esters prepared from fatty oils such as rapeseed, arachis, cottonseed, maize, ravision, sunflower seed, and soybean oils, in which the linoleic or similar two double-bonded fatty acid content ranges from 10-60% and in which the linoleic or similar three or more double bonded fatty acid is present in quantities less than 5%. The esters may be used alone or mixed with mineral oil during sulfurization and the product can be improved in color by clay or carbon treatment.

Karns[30] discloses that an improved extreme pressure lubricant is obtained by adding free sulfur or a sulfur treated animal, vegetable, or marine oil at elevated temperatures to a Pb soap (Pb oleate); oxidized mineral oil is used to solubilize the soap. Instead of using Pb oleate, Miller[31] used Pb naphthenates and sulfonates with sulfurized animal, vegetable, and marine oils in which sulfur is present in corrosive form, as extreme pressure agents for lubricating oils.

Used Sulfur and Chlorine

The utilization of a compound containing both sulfur and chlorine as an E.P. agent and the method of preparing it are disclosed by Wilkey,[32] who reacted mineral oil or mineral and animal or vegetable oil with dry flower of sulfur until the sulfur melted in the oil; whereupon dry chlorine gas was passed through the mixture and then allowed to cool. The reaction product was reheated to stabilize the sulfur, and the excess chlorine was removed by passing air through the heated mixture. The chlorine gas brought about a chemical action that caused the oil to change from a transparent to a jet black liquid.

Parkhurst[33] discovered that naphthenic constituents of hydrocarbon oils react more readily with sulfur than paraffinic constituents. These fractions were reacted with 5-10% sulfur at 250-550° F in an inert atmosphere to avoid oxidation until a product containing sulfur in stable form was produced. The sulfurized oil was subjected to distillation to remove undesirable constituents; it can also be treated directly with solvents, such as phenols, nitrobenzene, furfural, chloraniline, cresylic acid, SO_2 or B B^1 dichlordiethylether, which remove unstable sulfur constituents. Both extract and raffinate layers contain sulfurized materials. The raffinate layer after the solvent was removed from it was used as a gear lubricant. The product produced by this method had VI characteristics and E.P. properties.

Hendrey[34] reacted aromatic compounds of condensed ring nucleus, such as naphthalene, anthracene, diphenyl, diphenyl oxide, and mixtures thereof, with 1-5% sulfur at 400-450° F at superatmospheric pressure until the sulfur was chemically combined. The product was stable, had good color, did not precipitate sludge, and was used as a cutting and E.P. lubricant.

The Buxbaum patent[35] states that oils containing sulfur particles of a size above 5 μ are unsuited for certain lubricating operations. This is due to the fact that particles above this size cannot penetrate sufficiently into the capillary fissures of the metals treated but are retained or squeezed away at the working places at which high pressures act. In order to obtain an oil containing colloidally stable dispersed sulfur particles of a size not greater than 5 μ, Buxbaum grinds a sulfur-oil paste in a mill until the sulfur particles are of the desired size and then adds it to a suitable lubricating oil.

Oils having low oxidation rate and low sludging tendency were obtained by Rosen[36] by treating unsaturated hydrocarbons with sulfur or sulfur chloride, selenium, and tellurium compounds to produce sulfur compounds such as aliphatic and aromatic polysulfides, polyselenides, and polytellurides having the general formula

$$RR^1S-S-S_x$$

where R and R^1 are alkyl or aryl groups.

The products can also be obtained by treating mercaptans with sodium plumbite and sulfur to produce the polysulfides. The preferred unsaturated compounds used were cracked oils, cracked waxes, and unsaturated fatty acids (lard oil). When sulfur chloride was used as the sulfurizing agent, the reaction temperature was between 150-200° C.

Lincoln[37] discloses that dialkyl polysulfides such as diamyl, dibutyl, diethyl, dipropyl polysulfides, in lubricating oils to which free sulfur has been added, produce a non-oxidizing internal combustion engine lubricant and cutting lubricant. The sulfides act as solvents for the sulfur. A cutting and drawing oil base which was clear, noncorrosive, resistant to oxidation, and which prevented separation of sulfur, was obtained by Merriam[38] by reacting pine oil with sulfur and removing the unreacted constituents.

Nill[39] discovered a way of forming a stable solution of sulfur in mineral oil

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by dissolving the sulfur first in a solvent at a temperature below that at which the sulfur changes to a dark brown color. The sulfur which precipitates out on cooling has been found to be soluble in mineral oil; the product is transparent, odorless, and non-poi onous.

A cold drawing lubricating compound was prepared by Montgomery[40] by adding 10% sulfur to asphaltum bases such as vegetable distillate residue, coal tar residue or petroleum residues which have been thinned with light hydrocarbons, and heating the mixture to about 380-430° F.

Cutting and E.P. Bases

Cutting and extreme pressure bases were prepared by Magill[41] by reacting dihydronaphthalene dimers with sulfur at 140-170° C, or sulfurizing dihydropolycyclic aromatic hydrocarbons[42] or their homologues and adding them to a mineral or vegetable oil to obtain the final product. Cutting and extreme pressure lubricants also can be obtained by reacting sulfur with hydrocarbon resin[43] or gum having a formula $C_{40}H_{40}$ and exemplified by the resin "RH-35."[44]

An extreme pressure lubricant which prevents seizure and scoring of relatively moving metallic surfaces such as are encountered in metal drawing, gear and bearing lubrication, internal combustion engines, and top cylinder oils, is obtained by Prutton[45] by using a corrosive agent such as sulfur chloride treated mineral or non-mineral oil or fatty acids and a corrosive inhibiting agent of the organic esters of phosphorus and phosphoric acids and thiophosphorous acid type.

A non-oxidizing mineral oil was obtained by Wiezevich[46] by treating a mineral oil with silent electric discharges and adding 0.1-2% sulfur to the oil before voltolization in order to increase the efficiency of the voltolized product as an oxidation inhibitor.

Steiner [47] states that blending of petroleum oil with a true physical solution of sulfur in naphthalene and aromatic compounds such as chlorinated naphthalene derivative like penta, hexachloronaphthalene, decalin, and alkylated naphthenes produces a cutting oil superior to those containing sulfur compounds in which the sulfur is in chemical combination. Less sulfur is required to obtain cutting oils, the product is light colored and odorless and does not irritate the skin or congeal at low temperatures.

Additive for Alloy Bearings

A special oil additive for alloy bearings and one which improves the stability of oils, retards corrosion, and improves its film strength is prepared by Smith[48] by reacting sulfur chloride with aromatic or aliphatic mercaptans to produce polysulfides such as diamyl-trisulfides or tetrasulfide. The general formula for such reactions is believed to be $2RSH + S_2Cl_2 = R-S-(S)_2-S-R + 2HCl$.

An extreme pressure and cutting oil additive was obtained by Puryear[49] by reacting mixtures of lanolin and sperm oil with sulfur at 320-330° F for two hours. The resulting product is light colored and contains about 33% sulfur, of which 16% is in uncombined form. Another cutting oil was obtained by Pollak[50] by reacting refined tall oil in a vat of tricresyl phosphate with 10-30% sulfur at 300-400° F for about two hours.

An extreme pressure oil additive is obtained by Burk[51] by reacting mercaptides extracted with a sodium hydroxide solution from mercaptan containing petroleums with sulfur. The sulfurized compounds are separated from the caustic solution by suitable means and added to a lubricating oil or to lubricating oils containing minor amounts of Pb soaps. Another extreme pressure lubricant containing both sulfur compounds and lead soaps such as Pb oleate, naphthenate, or sulfonate is disclosed in the Morway patent[52]. To be effective, the sulfur should be in reactive form, the amount of sulfur being from 0.3-1.5% and the amount of Pb sufficient to form PbS with the corrosive sulfur. The sulfur compounds used are elemental sulfur, or sulfur cooked with animal, vegetable, marine, or mineral oils.

In order to stabilize mineral oils, James[53] added minor amounts of sulfur chloride and alkylamine reaction products. The reaction is believed to proceed as follows:

$$4RR^1NH + S_xCl_2 \rightarrow RR^1N-S_x-NRR^1$$

Although sulfur has been known to stabilize oils, it is not suitable for stabilizing transformer oils, technical white oils, and turbine oils, because it is corrosive. Suitable stabilizing agents for such oils, according to Story[54] are alkyl disulfides and aralkyldisulfides such as diethyl, di-n-butyl, di-isoamyl, dibenzyl, diphenyl ethyl, diphenyl n-propyl, benzothialzole, and tetra-methyl thiuram disulfides.

Improved extreme pressure soda soap greases of the driving journal compound type are obtained by Brunstrum [55] by pretreating fatty materials and mineral oil with 1-4% sulfur at 200-400° F prior to or during manufacture of the soap.

Non-Corrosive to Alloy Bearings

A lubricant which is non-corrosive to alloy bearings and which imparts film strength and oiliness is obtained by Lincoln[56] by reacting high molecular weight olefins with sulfur at 300-360° F. The olefins are obtained by halogenating a paraffin wax of 18-24 carbon atoms and extracting the unhalogenated fraction by selective solvent extraction. The mono chlor wax is separated by dissolving in acetone, removing the undissolved fraction, and chilling. The olefins are obtained from the mono-chlor wax by heating with lime between 200-500° F. Unsaturated aliphatic materials reacted with sulfur chloride so that both sulfur and chlorine enter the reaction are disclosed by Wasson[57] and are used as a high temperature additive for lubricants.

Unsaturated paraffin wax, long chain olefins, unsaturated fatty acids, and esters such as glyceryl or glycol esters, monohydric alkyl esters and alcohols, and the like, are reacted with sulfur chloride. Polysulfides are believed to be formed and the product at this point is corrosive. To make it non-corrosive, it is steamed in the presence of alkali so as to remove part of the chlorine and replace it with hydroxyl groups. Colin[58] discloses that 1% or less than 0.1% sulfur, when added to an oil, produces an improved internal combustion lubricant which is non-corrosive to alloy bearings.

Zimmer[59] obtains an oil additive by sulfurizing a solvent extraction product of petroleum at 300-400° F with sulfur. The product is cooled rapidly to prevent internal reactions. If desired, the product can be re-sulfurized to improve its E.P. properties. Instead of sulfur, sulfur chloride[60] could be used as the sulfurizing agent for solvent extract of petroleum fractions.

Crankcase Lubricant

A synthetic lubricant for internal combustion engines which prevents scoring and scuffing of pistons and cylinder walls and piston rings is obtained by reacting isobutylene polymers[61] with sulfur at 375-400° F for 60-120 minutes so that no more than about 0.05% sulfur is present in the reaction product. If sulfur chloride is used as the sulfurizing agent, the initial temperature should be about 100-110° F about 30 minutes, and finally 300° F for one hour. Instead of sulfurizing isobutylene polymers with sulfur in order to obtain an internal combustion engine lubricant, Barnard[62] adds isobutylene polymers to a naphthenic or coastal lubricating oil and adds 0.005-0.5% sulfur, or uses a high sulfur containing mineral oil such as a Winkler crude oil. The additive inhibits carbon deposits on pistons and piston rings and prevents ring sticking.

A lubricating base is obtained by Dearborn[63] by reacting unsaturated monocarboxylic acids with sulfur at 160-200° C, using iodine as a catalyst and neutralizing the reaction with alkali, alkaline earth, and heavy metals. With oleic acid and sulfur, the reaction is believed to proceed as follows:

$$CH_3(CH_2)_7CH=CH(CH_2)_7COOH + S \rightarrow CH_3(CH_2)_7\underset{\displaystyle -S-}{CH-CH}(CH_2)_7COOH$$

Using linolic acid with sulfur, the sulfur combines in the following manner:

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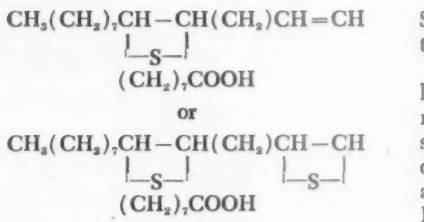
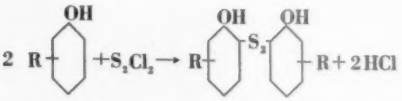


or

Burk[64] discloses that lubricants containing Pb salts whose acid has been obtained by oxidizing a mineral oil are improved by adding sulfur or chlorine or both to the lubricant.

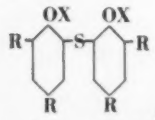
A sulfurized compound suitable for use as a cutting and drawing lubricant and gear and E.P. lubricant is greatly improved when re-sulfurized. To obtain such a product, Zimmer[65] reacted terpenes, pine oil, rosin, purified rosin, and hydroxy rosin, esters of rosin, hydroxy rosin acids, fatty oils and acids, cracked oils and waxes, unsaturated oils and copolymers, with 2-15% sulfur or sulfur chloride at 300° F until the sulfur was permanently bound to the carrier in chemical form. This product was blended with mineral oil and heated with 0.5-2.5% sulfur at 300-500° F. Such a product prevents sulfur separation, increases load capacity of an oil, and does not decompose or polymerize as some types of sulfur reactions do.

A lubricant especially suitable for steel bearings under E.P. conditions, hypoid gears, and for cutting and transmission is prepared by Mikeska[66] by reacting phenols with sulfur monochloride. The reaction proceeds as follows:



Instead of sulfur monochloride, sulfur dichloride or a mixture of sulfur mono and dichloride could be used in the reaction.

Cook[67] states that although p-alkyl phenol sulfides are good corrosion inhibitors, they tend to polymerize and form sludge, which is due to the position of the benzene ring ortho to hydroxy group, since it is free and hence active. To obtain an improved sulfide oil additive which is non-sludging and which inhibits corrosion, Cook reacts dialkyl phenol with SCl_2 in a solution of CCl_4 or any suitable solvent and then forms a salt, using Sn, Ba, or Zn. The oil additive so formed has a general formula of



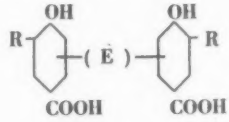
R = alkyl radical
X = hydrogen or metal

and is used for diesel, tractor, and airplane engine lubrication.

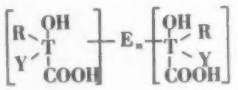
An extreme pressure lubricating oil additive was obtained by Mikeska[68] by reacting potassium xanthate with S_2Cl_2 or SCl_2 to produce organic xanthogen tetrasulfide.

To obtain a light colored, sludge-free lubricating oil additive, Segesseman[69] reacted unsaturated aliphatic alcohols, such as oleyl, lin oleyl, ricinoleyl, hexadecenyl, erucyl, alcohols, and unsaturated alcohols obtained from sperm oil, Dogling's oil, fatty alcohols, etc., with sulfur. To form emulsions, sulfonated sperm oil, mahogany sulfonate, fatty acid soaps, etc., are added.

In order to improve the pour point and VI of a lubricating oil, as well as to prevent oxidation, ring sticking, etc., Reiff[70] reacted alkylated hydroxy aromatic acids with sulfur chloride. The reaction product was then washed to remove the HCl formed or neutralized. The resultant products were sulfides of alkyl-substituted hydroxy aromatic acids, the general formula being:



The salts of alkali and alkaline earth metal sulfides of alkyl-substituted hydroxy aromatic carboxylic acid were also prepared by Reiff,[71] and the simplest general formula of such compounds is:

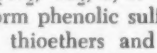


T = mono or poly-cyclic aromatic nucleus.
E = S, Se, Te.
n = 1 – 4.
Y = residual hydrogen or substituent group.
X = hydrogen or metal.
M = hydrogen or metal.

An extreme pressure, non-corrosive lubricant was obtained by Lincoln[72] by retreating unsaturated acids such as oleic, linoleic, linolenic, elaidic, corn oil acids, soy oil, lard oil, tung oil, abietic, cholic, naphthenic acids with sulfur or sulfur chloride and neutralizing the reaction to form the sulfurized acid salts or soaps.

A synthetic stable lubricant which could be used per se or added to a suitable lubricant was obtained by Pier[73] by treating hard paraffin wax and 30% ceresine and 0.5% sulfur in a Siemens ozonization tube under pressure with silent electric discharges, and distilling off the unreacted portion. The condensation product contains about 0.3% sulfur.

Novel lubricating oil oxidation inhibitors were obtained by Richardson[74] by reacting phenols or phenol sulfides with S_2Cl_2, CS_2, S, or $SeOCl_2$ at 60-140° C to form phenolic sulfides such as alkyl phenol thioethers and alkyl phenol disulfides having the general formula



where R = hydrocarbon group.
R^1 = aromatic nucleus group

The compound is then subjected to silent electric treatment, which polymerizes the product and makes it non-corrosive. A non-corrosive, non-staining extreme pressure lubricant is obtained by McNulty[75] by adding various amines to sulfurized non-corrosive fatty oil, chlorinated wax, and mineral oil.

Subkon[76] discloses that lubricating oils containing minor amounts of sulfur in the form of thioether or sulfides, disulfides, or polysulfides, are very effective as oxidation and corrosion inhibitors for Cd-Ag and Pb-Cu bearing alloys. Bergstrom[77] discloses that lubricants containing salts of petroleum sulfonates are greatly improved by the addition of sulfurized esters of monohydric alcohols and monocarboxylic acids obtained by treating the ester with sulfur or sulfur chloride.

Larsen[78] discloses that unsaturated alkyl maleic and succinic acids can be stabilized by reacting them either with sulfur at 160-200° C or with SCl_2 and S_2Cl_2 at room temperature in the presence of a solvent inert to halogenation.

Oxidation and Sludge Inhibitor

A lubricating oil additive which is capable of inhibiting oxidation, dispersing sludge, and imparting E.P. and pour point properties is obtained by Morway[79] by treating high molecular weight hydrocarbon polymers with sulfur mono or dichloride either alone or with a solvent for the polymer.

Instead of using sulfurized and chlorinated derivatives for lubrication of machinery operating under E.P. conditions, such as are developed in steel mills, rolling necks, and worm and hypoid gears, van Dijck[80] uses elemental phosphorus, As, Se, Te, or their organic or certain inorganic compounds, such as oxides or sulfides, admixed with mineral oil, alkali, or Pb or Al soap, mineral oil greases, or animal or vegetable oils, so that the various additives are distributed in the lubricant colloidally.

Rosen[81] discloses that trisulfides such as are obtained by reacting amyl mercaptans in CS_2 with SCl_2 to produce diamyl trisulfide increase the film strength of lubricants, prevent oxidation and sludge formation, and are non-corrosive. Desirable oil additives are diethyl, diisopropyl, dibutyl, dihexyl, and dibenzyl trisulfides.

In order to obtain a transparent cutting oil lubricant, Kaufman[82] sulfurizes a light colored pale mineral lubricating oil under controlled conditions of low temperature and atmospheric pressure so as to provide 1.0-1.75% loosely combined sulfur in the oil, and stabilizes the sulfurized oil by adding an E.P. base, such as tricresyl phosphate and phosphite, triphenyl phosphate and phosphite, dibutyl phosphate and phosphite, chlo-

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Reprints Available of the SERIES on LUBRICATING OIL ADDITIVES

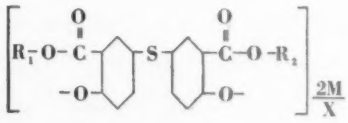
The accompanying is the second in a series of three articles appearing exclusively in the NPN Technical Section, in which lubricating oil addition agents are grouped by chemical types and the patent history of the groups presented and their properties discussed.

The first article in the series, on Sulfonation Derivatives, was published in the Oct. 3rd NPN Technical Section (pg. R-793). The third article, on Phosphorus Sulfide-Organic Reaction Products, will appear in the Dec. 5th NPN Technical Section.

Readers who desire this material for their files may secure reprints of the three articles (when complete) at 25c per set. Address requests to: Technical Editor, National Petroleum News, 1213 West Third St., Cleveland 13.

rinated diphenyl, chlorinated fats and fatty oils, chlorinated wax, and sulfurized diphenyl. Another cutting oil additive is obtained by Lutz[83] by reacting with 20-30% sulfur at 300-375° F cycle oil obtained by gravity from a cold H_2SO_4 extract of a high sulfur petroleum fraction. The utilization of sludge oils from the acid treatment of cracked naphthas to form a suitable E.P. agent by chlorinating and hydrolyzing such oils in the presence of solvent until the oils absorb about 10-30% chlorine is disclosed by Armendt.[84] This product is then reacted with reactive sulfur compounds or elemental sulfur at 200-400° F.

A product to improve the lubricating properties of lubricating oils is disclosed by Cook [85] and is obtained by reacting 2, 4 ditertbutylphenoxyethanol with SCl_2. To obtain an oil that not only possesses corrosion inhibiting properties but detergent properties as well, Cook[86] reacts sulfur chloride or $SOCl_2$ with aliphatic or cycloaliphatic ester of salicyclic acid to form sulfides having the formula



R_1 and R_2 = alkyl or cyclo alkyl radicals
M = metal.
X = valence of metal.

To obtain a mild extreme pressure agent, Cohen[87] reacted polymers of low molecular weight containing less than six carbon atoms, such as ethylene, propylene, butylene, and amylene, as well as copolymers of iso olefin with other olefins and sulfur or sulfur chloride at about 180-250° C.

An anti-welding lubricant is obtained by Tighe[88] by sulfurizing an oil while blowing air through it. The oil is then cooled and acidified. After separating out solid matter, the sulfurized oil is subjected to the action of finely divided absorbents such as clay, fuller's earth, etc, to obtain a clear and transparent lubricant.

An extreme pressure lubricating oil additive was obtained by Berger[89] by reacting perchloromethyl mercaptan with elemental sulfur at 145-170° C

A VI increasing and EP oil additive was obtained by Anderson[90] by reacting with 1-25% sulfur at 200-450° F a high molecular weight hydrocarbon resin obtained by polymerizing isobutylene with $AlCl_3$ and having the formula C_nH_{2n}. To improve the oxidation stability, oiliness, and E. P. characteristics of oils, Loane[91] oxidized low molecular weight iso mono-olefin polymers and copolymers, such as isobutylene, isoamylene, etc., at 100-400° F with oxygen containing gases, and then sulfurized the product at 250-520° F with elemental sulfur until the sulfur was chemically stable.

To obtain a detergent and rust-inhibitin oil additive, McNab[92] reacted diisobutyl phenol in chloroform with SCl_2 at 100° C to form the sulfide, and, upon neutralization with barium, the final product, barium salt of diisobutyl hydroxy phenyl sulfide, was obtained.

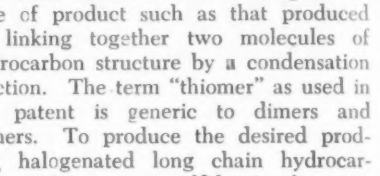
Pour Point Depressant

Lieber[93] discloses that a pour point depressing agent in waxy lubricating oils is obtained by reacting halogenated aliphatic organic compounds with an inorganic sulfur containing material. The organic compounds used were halogenated paraffin wax and petrolatum, kerosine, gas oil, lubricating oil, higher alcohols, aldehydes, ketones, acid esters, etc., containing five or more carbon atoms. Specific compounds used were: Phenyl alcohol, octadecyl alcohol, lauric aldehyde, diisobutyl ketone, stearic acid, heptyl acetate, ethyl stearate, isopropyl esters of wax, oxidized acids, etc. The sulfurizing agents used were inorganic polysulfides or mixtures with elemental sulfur such as sodium pentasulfide.

Downing[94] discloses an internal combustion engine lubricant containing copper compounds such as copper oleate, naphthenate, etc., and sulfur containing compounds such as sulfurizing dehydrated unsaturated alcohols at 130-200° C obtained from sperm oil, beef tallow, lard, cottonseed, olive, corn, rapeseed, menhaden, soya bean, linseed, and China oils as well as "ocenols", oleyl, abietyl alcohols, and their esters, and cetene, abietene, cyclohexyl, dihydronapthalene, menthene, dipentene terpinene, and terpinolene.

As improving agents for lubricating oils, Moxley[95] sulfurized at approximately 300° F in the presence of water and under pressure of H_2S, non-glyceride fats, such as lanolin and sperm oil, and used the product in combination with metal salts of organic esters of phosphorus acid, such as calcium isoamyl octyl o-phosphate.

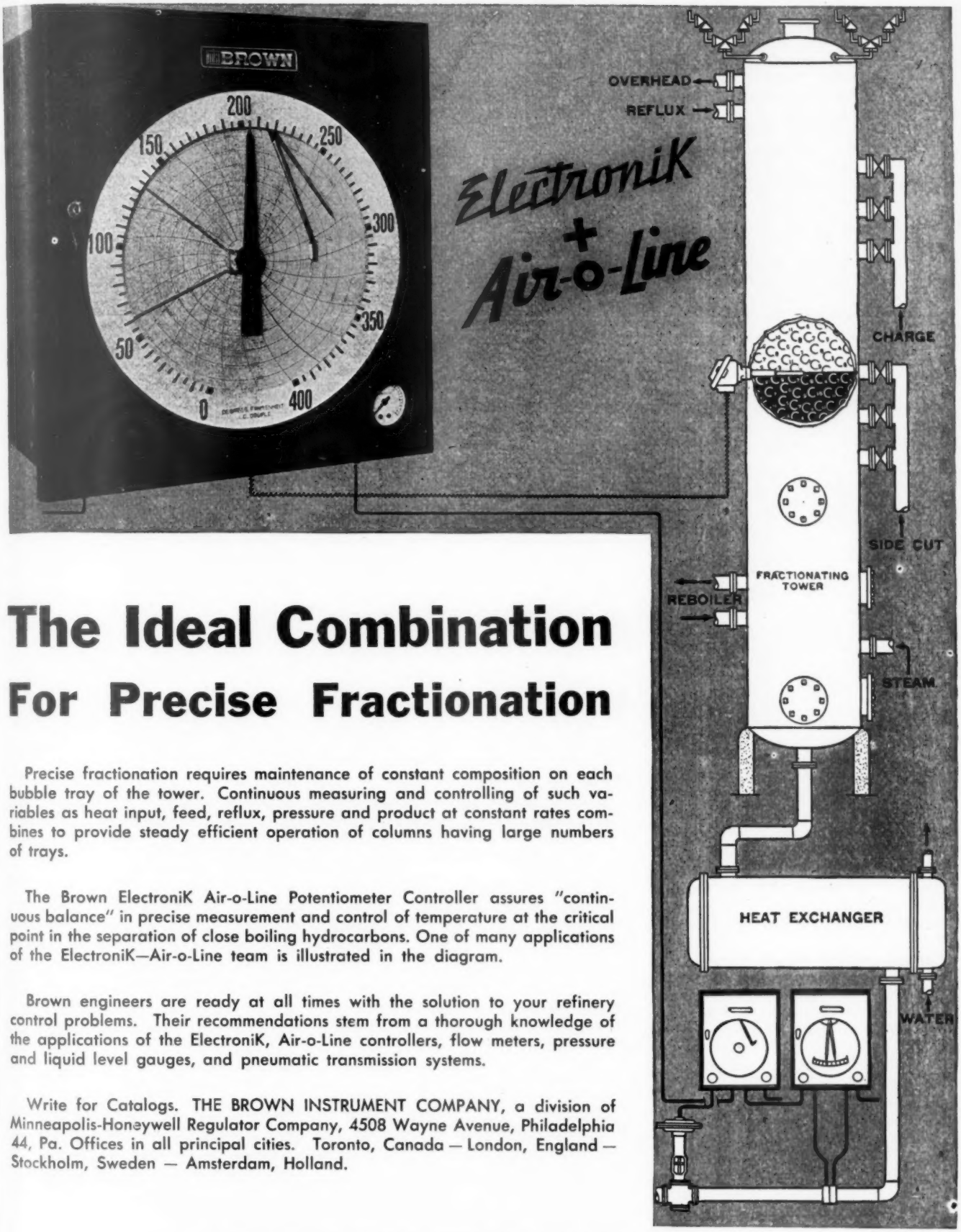
A lubricant for internal combustion engines and hard metal bearings, noncorrosive in the presence of highly refined lubricants under severe operating conditions, was obtained by Farrington[96] by using long chain multi-bridged thioalkyl compounds having carbon to carbon chains of 20 or more carbon atoms in length and preferred type, termed by Farrington "paraffin wax polythiodimers." The term "dimer" as used designates a type of product such as that produced by linking together two molecules of hydrocarbon structure by a condensation reaction. The term "thiomer" as used in the patent is generic to dimers and trimers. To produce the desired product, halogenated long chain hydrocarbons and inorganic sulfides in the presence of sulfur are reacted as follows:



The paraffin wax thiomers are from four to eight times as effective as cetyl ethyl sulfide, and more than three times as effective as a conventional dialkyl disulfide. The product could be used in combination with such stabilizing agents as metal phenates, salts of aryl carboxylic acids, salts of polycarboxylic acids which have been partially esterified, metal alcoholates, and salts of alkyl carboxylic acids containing a polar group near a carboxyl group of the acid.

A non-corrosive, sulfur bearing addition agent which increases the film strength and reduces oxidation, sludge, and acid formation is obtained by Lincoln[97] by reacting with sulfur, sulfur chloride, H_2S, P_2S_5, alkali metal hydrosulfides and polysulfides, fraction cuts from gasoline, high boiling narrow cuts, such as Stoddard solvents, portions of kerosine, gas oil, wax distillates, paraffin wax, foots oil, etc. Before sulfurizing, the product is halogenated and so treated as to introduce into the product one or more double bonds.

In order to obtain an improved lubricating oil composition, Prutton[98] added sulfur treated oils, such as lard or fish oil, in which the sulfur was in active or loosely combined form, in combination



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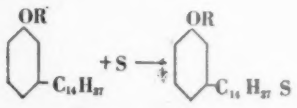
with a halogenated hydrocarbon material.

Waugh[99] discovered that compounds of antimony or bismuth activate E.P. lubricants containing free sulfur-containing mineral oil or chlorinated compounds. Some antimony and bismuth compounds used were antimony or bismuth isoamylates or ethylates, triphenyl bismuthines, and antimony oleate.

A lubricant for protecting metal parts exposed to the action of H_2SO_4, $CaCl_2$, chlorine gas, ammonia, etc., was obtained by Hale[100] by reacting a mixture of blown or unblown asphalt and petroleum oil with sulfur at 350-500° F.

Henry[101] found that by adding sulfur to an unrefined lubricating oil stock, such as an Oklahoma City crude oil having a VI of 75-80 and a sulfur content of 0.2-0.3%, an improved sulfur-in-oil product is obtained which reduces wear, oxidation, and corrosion of alloys.

A non-corrosive, non-oxidizing oil additive was obtained by Patterson[102] by sulfurizing products derived from cashew nutshell oil in hydrocarbon oil and reacting with a metal. To prevent oxidation and sludge and acid formation in lubricating oils, Otto[103] sulfurized cardanol ethers or cardanyl ethers at 175° C for 24 hours in the presence of a non-oxidizing gas. The reaction is believed to proceed as follows:



McCleary[104] obtained a non-corrosive oil additive by reacting with sulphur at 150-160° C for six hours partially hydrogenated cardanol, cooled and reacted with a salt such as barium.

An extreme pressure oil additive was obtained by Morway[105] by reacting a high molecular weight polymer such as isobutylene either alone or with a solvent, with S_2Cl_2 or SCl_2. A lubricant for bearings and cylinders of internal combustion engines having E.P. properties and suitable for cutting oils was obtained by Towne[106] by reacting a depolymerized rubber polymer with sulfur chloride so that both sulfur and chlorine entered the product.

A gear lubricant containing sulfurized sperm oil is inhibited against foaming, according to Smith[107], by adding minor amounts of potassium oleate.

In order to obtain an improved oil additive, Smith[108] acidified an oil before reacting it with sulfur. The sulfur is present in active form and should be neutralized before adding it to a lubricating oil. By acidifying the oil before reacting it with sulfur, lower reaction temperatures are required, and the sulfur does not darken the oil.

Conclusions

Sulfur and sulfur chloride organic reaction products have been and still are quite popular as lubricating oil addition agents.

Much theory and speculation have been offered through the years as to just how organic sulfur-containing materials improve the lubricating properties of oils and in what form the sulfur should be present in order to obtain the most desirable results. Sulfur in the free state or in a chemically reactive form increases the film strength and imparts extreme pressure properties to lubricants. However, in most cases when sulfur is in this form, it is usually corrosive and tends to form sludge during use or precipitate out of the lubricating vehicle in which it has been dissolved or dispersed. On the other hand, sulfur chemically combined with organic materials with which it has been reacted loses much of its extreme pressure properties and is unsuited for many lubricating purposes.

It appears, therefore, the aim and goal of the lubricating engineer to produce an oil additive of this type in which the sulfur is in reactive form but not corrosive to the metals and alloys with which it might come in contact, and without the tendency to form sludge or precipitate out of the lubricating vehicles in which it may be dispersed.

As shown by the references cited, much work has been done and great improvements have been effected in producing sulfur containing oil additives in which sulfur's undesirable characteristics as an oil additive have been alleviated and its desirable properties improved and enhanced.

However, much study, research, and work lie ahead in the improvement of known sulfur and sulfur chloride organic reaction products as lubricating oil additives, as well as in the development of new and more potent organic sulfur and sulfur chloride reaction products as addition improving agents for various lubricating purposes.

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Note: Numbers in parentheses after the patent numbers are the year in which the patents were issued; e.g. (68) is 1868, (33) is 1933.

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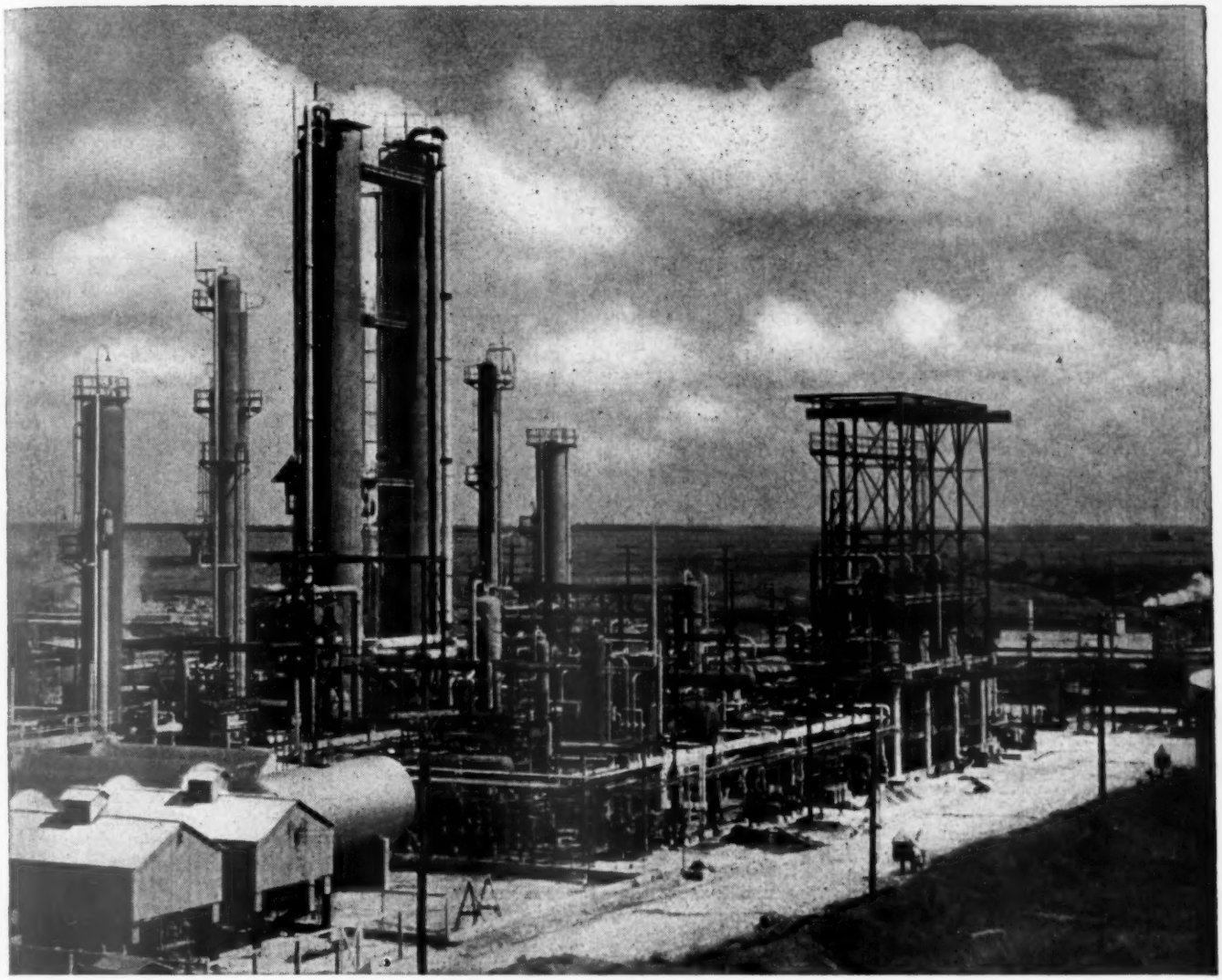

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INDUSTRIAL LUBRICATION

By W. G. Forbes

7—Detergent Oils

W. G. Forbes, who had been contributing this regular feature to the *NPN Technical Section* since last May, was drowned July 29. He was Lubricating Engineer for the Tide Water Associated Oil Co., New York.

Before his death, however, Mr. Forbes had prepared a number of installments of his material in advance and submitted them to the editors. We will attempt to continue presenting his valuable contributions to the literature in the field of industrial lubricants and industrial lubrication as long as they are available.

Q—What is a detergent oil?

A—Detergent oils contain compounds which cause the oil to hold in suspension finely divided particles, such as soot and products of oil oxidation, which would normally precipitate out and form sludges, or attach themselves to engine parts and build up into deposits.

By holding the above mentioned products in suspension in a highly dispersed or colloidal form (a very finely divided form), these products are much less able to settle out in the form of carbon, sludge, etc., and are drained out with the oil at periodic drainage intervals, thus leaving a clean engine. Oils which do not have these properties are unable to keep these finely divided particles of soot, gums, etc., in finely dispersed form, hence they coagulate, forming larger particles which settle out on various parts of the engine in the form of sludges, lacquers, carbon, etc. These deposits are the direct cause of stuck rings, plugged oil leads, and high temperature sludge deposits throughout the engine.

Q—Will detergent oils free stuck piston rings?

A—If the piston rings are actually frozen in their grooves it is not believed that detergent oils will free them. They may free the rings in time, but there is generally little assurance that this action will take place.

Sluggish rings however, which still permit a certain amount of oil to circulate around them, may be freed. The action of the oil is one of dispersion, hence there is a tendency for the oil to disperse the tacky materials holding the carbon, which are the products causing the rings to stick. If the gummy material has not become too severely oxidized or polymerized, then it is believed that the detergent will free the rings.

Q—Why are detergent oils not used more extensively in large Diesels?

A—Detergent oils may be used in any type of internal combustion engine, but in large Deisel installations the oil charge is an expensive item. Detergent oils cannot be filtered as easily as straight mineral oils, hence economic considerations favor the use of straight mineral oils for crankcase lubrication in large installations.

In the smaller gasoline and Diesel engines, as, for example, automotive engines, the oil charge has to be changed quite frequently, regardless of whether or not a detergent oil is used. Hence the economic question does not arise to any appreciable extent, and if it does arise in such cases as large fleet operations the advantage of maintaining clean engines generally outweighs the economic considerations of operating an oil reclaiming process.

On the other hand, in large Diesel installations the oil charge in the crankcase amounts to several hundred gallons of oil and this charge is continuously cooled by means of an oil cooler. Furthermore, there is always enough room to install very effective filtering equipment; hence the problem of maintaining the crankcase oil in good condition over an appreciable period of time is comparatively simple with large installations such as power plant and marine installation. These aids are not present in small engines.

When Diesels are designed with cross heads and oil cooled pistons, the crankcase oil is entirely separate from cylinder lubrication, and in such engines the use of a detergent oil in the crankcase would, of course, serve no useful purpose.

Other factors also enter this rather controversial subject of where, and when, to use a detergent oil or a straight mineral oil. Large Diesels operate at slower speeds, and for this reason combustion is generally more complete and cylinder deposits are therefore less troublesome than in the smaller high speed engines.

Q—What types of oil filters are most suitable for filtering detergent oils?

A—The most suitable filtering mediums are cotton waste, wood fibre, and similar materials which will extract the larger impurities from the oil charge, but will not interfere with or remove the detergent compound.

Clay filtering materials such as fullers earth are not suitable for use with compounded engine oils because they remove the compounds. The same is true of batch filtering processes wherein the used oil is treated with chemicals. Such methods will remove the beneficial additives as well as the carbon, acidic materials, sludges, etc., in the used oil. Hence it may be stated that detergent oils cannot be reclaimed in the same sense that straight mineral oils may be filtered to remove a substantial percentage of the products formed by deterioration in service.

Detergent oils discolor easily in the crankcases of gasoline and Diesel engines because the dispersed material is retained in such a fine form. Consequently, when the charge is drained it may be discolored to a point where it is almost black as a result of suspended soot, etc. Unfortunately the most suitable filtering mediums are not sufficiently selective to remove these materials. However, the fact that the detergent oil is badly discolored upon removal, is simply an illustration of the fact that the materials which would otherwise cause deposits to form have drained out with the oil.

Q—Will detergent oils last longer than conventional straight mineral oils?

A—The same oil change periods are generally followed when using detergent oils.

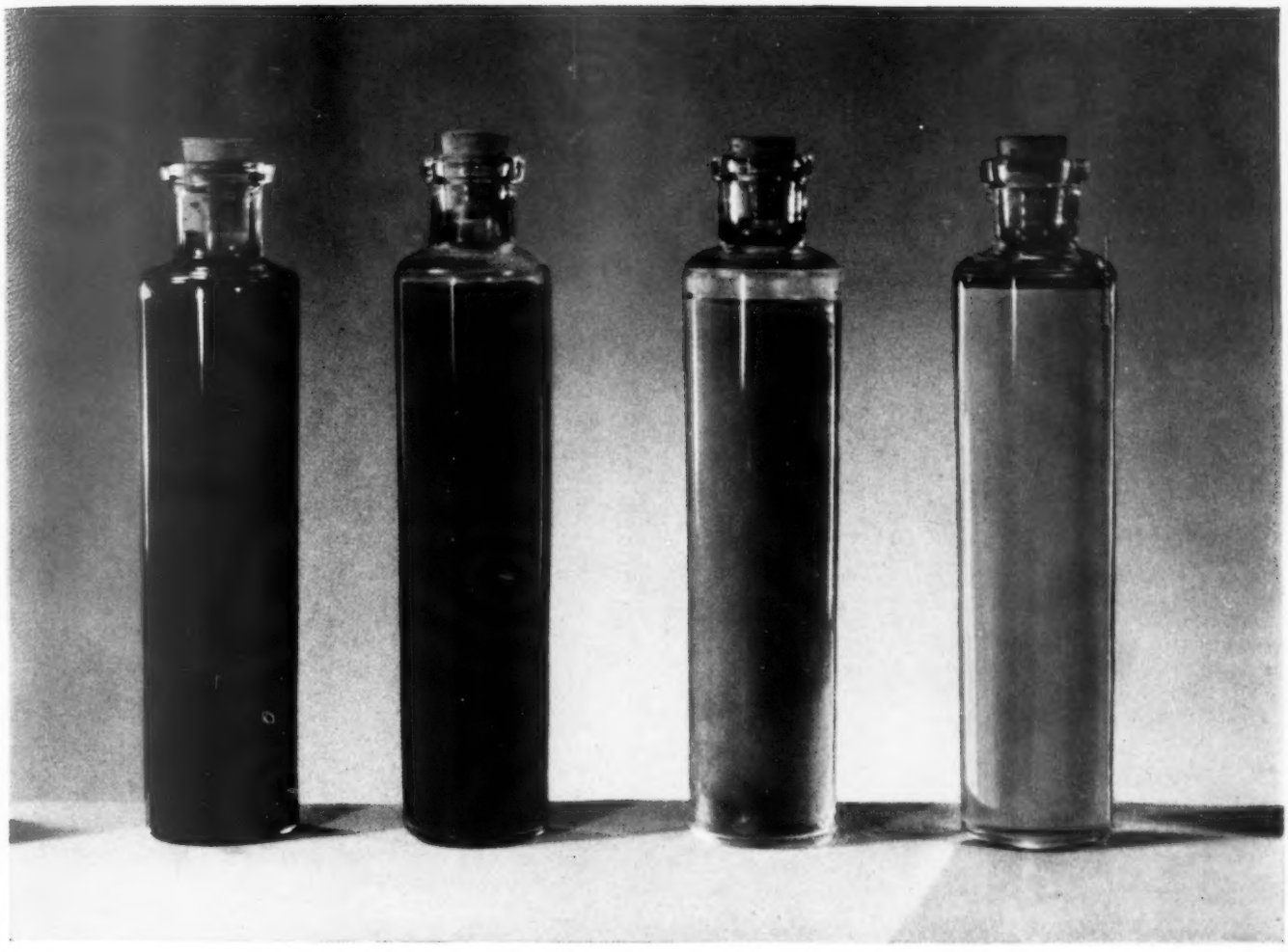
In this connection large fleet operators generally change oil in the engine crankcases every 2000 to 3000 miles when using detergent oils. This practice has been established as a result of considerable laboratory work and practical experience with these oils. This program is invariably based on maintaining the oil level at the "full" mark from day to day, and of course maintaining the equipment in good mechanical condition.

Under less favorable conditions the oil should be changed oftener, regardless of type, and the change period may be 500 to 1000 miles for engines operating in dusty localities, etc.

Q—What laboratory methods are employed to test used oil's from the crankcases of internal combustion engines?

A—The principal tests are: Neutralization number, percent of insoluble materials, viscosity, percent of ash.

Other tests are: Percent dilution with fuel, percent water present, carbon residue, flash point, gravity, analysis of the ash, presence of detergent compounds, anti-oxidants, etc.



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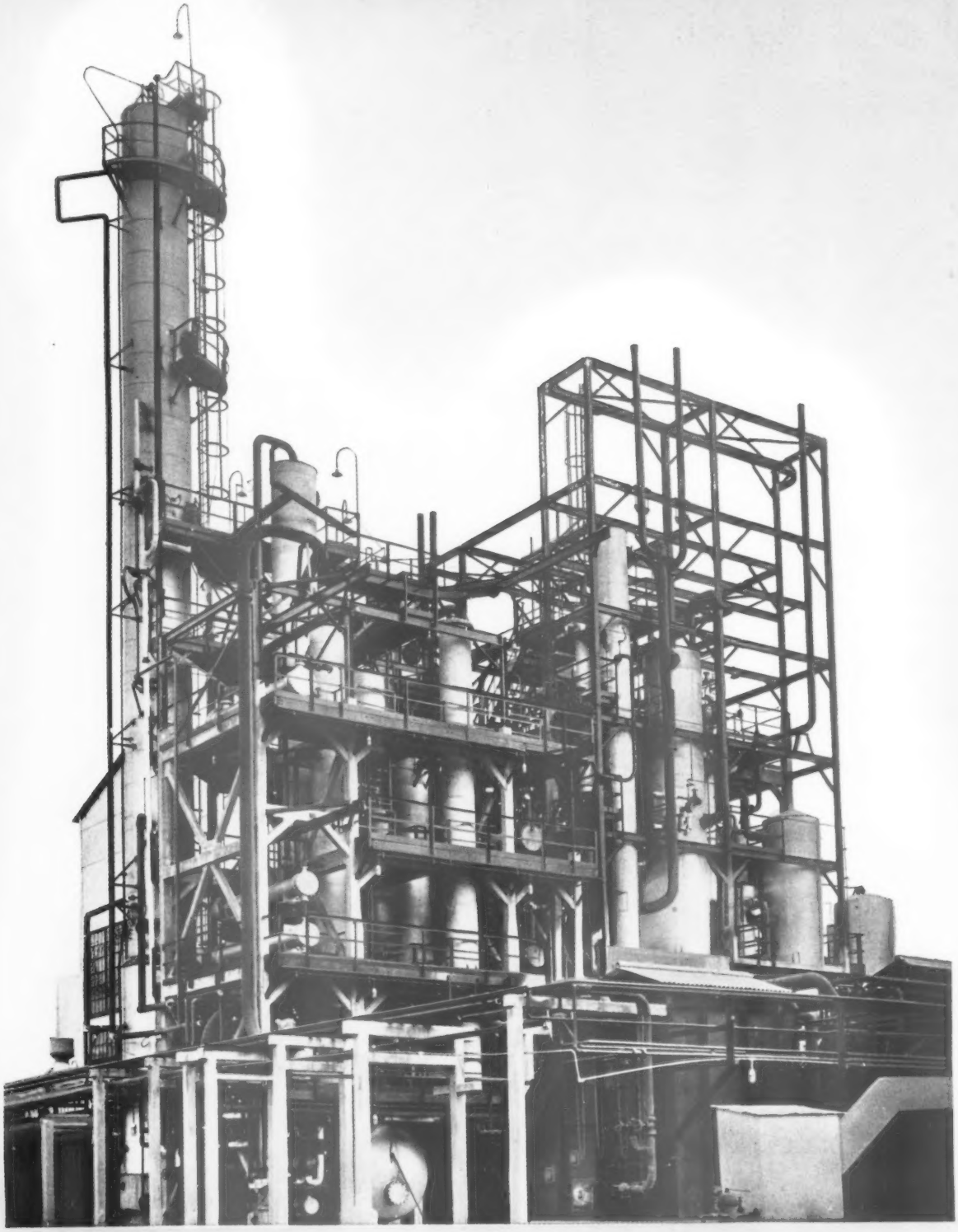

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Neutralization Number Test for Additive Oils Is Subject to Misinterpretation

By D. P. Thornton, Jr.
Assistant Editor, NPN Technical Section

NEUTRALIZATION number specifications of lubricating oils are being misinterpreted by some industrial consumers as indicative of the service characteristics of oils, particularly as applied to oils containing additives. Consequently the danger is seen that, as a result of misunderstanding of the true function of the neutralization number test, the full development of additive-type oils for heavy-duty service may be handicapped.

The neutralization number test was originally adopted for refinery control purposes to determine the extent of removal of acids, alkalies and other undesirable constituents in the refining and treating processes. Now, however, it is being used in many instances as a criterion of the remaining service life in a used oil. While a modern additive-type oil may have both acid and alkaline neutralization numbers, it is recognized that there is no valid correlation between these numbers and the corrosivity of the oil in service.

Recognizing the confusion resulting from the above conditions, Sub-committee XIII on Neutralization Number and Saponification, of Committee D-2 on Petroleum Products and Lubricants of the American Society for Testing Materials held a symposium at Detroit on the subject a few months ago.[1] H. P. Ferguson, Cleveland, Standard Oil Co. (Ohio), chairman of the sub-committee, presided. In arranging the program it was hoped to secure answers to the following questions from the viewpoint of industrial, turbine and automotive engineers:

"1. Do the present methods for determining neutralization numbers give the engineer and petroleum technologist the kind of information desired with respect to new and used lubricating oils?

"2. If they do not, what information is desired and wherein do the present methods fail?

"3. Can the present methods be modified or can new methods be devised to give this information?"

Accordingly the opinions of the three groups, represented by five papers comprising the symposium, are presented below. The papers and authors are:

"Neutralization Number from the Viewpoint of the Industrial Engineer," C. L. Pope, lubrication engineer, Eastman Kodak Co., Rochester.

"Neutralization Number from the Viewpoint of the Turbine Engineer" (two papers.) by F. C. Linn, Turbine Engineering Division, General Electric Co., and chairman Technical Committee C, on Turbine Oils of Committee D-2, and G. H. Von Fuchs, Shell Oil Co.

"Neutralization Number from the Viewpoint of the Automotive Engineers," H. R. Wolf, Research Laboratories Division, General Motors Corp.

"A Comparison of the Salt Method with A.S.T.M. D-663 Method for Determining the Acidity of Lubricating Oils," C. M. Loane, Research Department Standard Oil Co. (Indiana).

Industrial Engineers

Industrial engineers look upon neutralization number specifications for non-additive oils for much the same information as the test was originally created to supply—an indication of the presence of simple acid or alkali resulting from refinery treating. Some indeed regard the test as a throwback to earlier days and now useful only as a refinery control means. However, few are willing to advocate discontinuing the test, pointing out that while by itself it is not an adequate basis for judging a new oil, it is useful for detecting a wide variation from the established value for a specific brand. Permissible maxima on such variations generally ranged from 0.02 to 0.15 in the replies to the symposium questionnaire.

For new additive-type oils, however, it is apparent that users expect unusual values ranging from acid to alkaline, and distinctly different from values for non-additive oils. Consumers seemingly realize that unusual neutralization numbers for additive-type oils are not important providing these oils are superior to the non-additive oils for some services. One reply to the questionnaire was of interest for the statement that, if a differentiation between additive and non-additive oils were made, a stumbling block in developing superior additives would be removed.

Neutralization numbers are commonly used by industrial engineers in checking used non-additive oils for deterioration, although the manner of applying the data varies. Half of the replies to the questionnaire indicated users base decision to renew the oil on a maximum limit established by experience, ranging generally from 0.20 to 2.0, with limit for the majority between 0.7 and 1.0. The other half of the users are divided between those who use the rate of increase in neutralization number and those who use both a maximum limit and rate of increase as indicative of the degree of deterioration of the oil.

Many were of the opinion there is some degree of correlation between sludge deposits and neutralization number. However, most sources admitted that materials of construction and humidity, temperature and other conditions of use were strongly disposing factors, agreeing that any such correlation could only be on the basis of individual experience with specific oils in single items of equipment.

Replies to the questionnaire in general indicate industry does not appear to be well versed in the use and behavior of additive-type oils in service. A number of users are unwilling to limit a refiner to a given maximum neutralization number providing a suitable product can be produced.

In the case of non-additive types, neutralization number limits are well established and the test data on used oils are factors used in determining deterioration. Both colorimetric and electrometric methods are in use for determining neutralization number[2] with the former predominating because of the simple equipment and reliability of results technically with unskilled personnel.

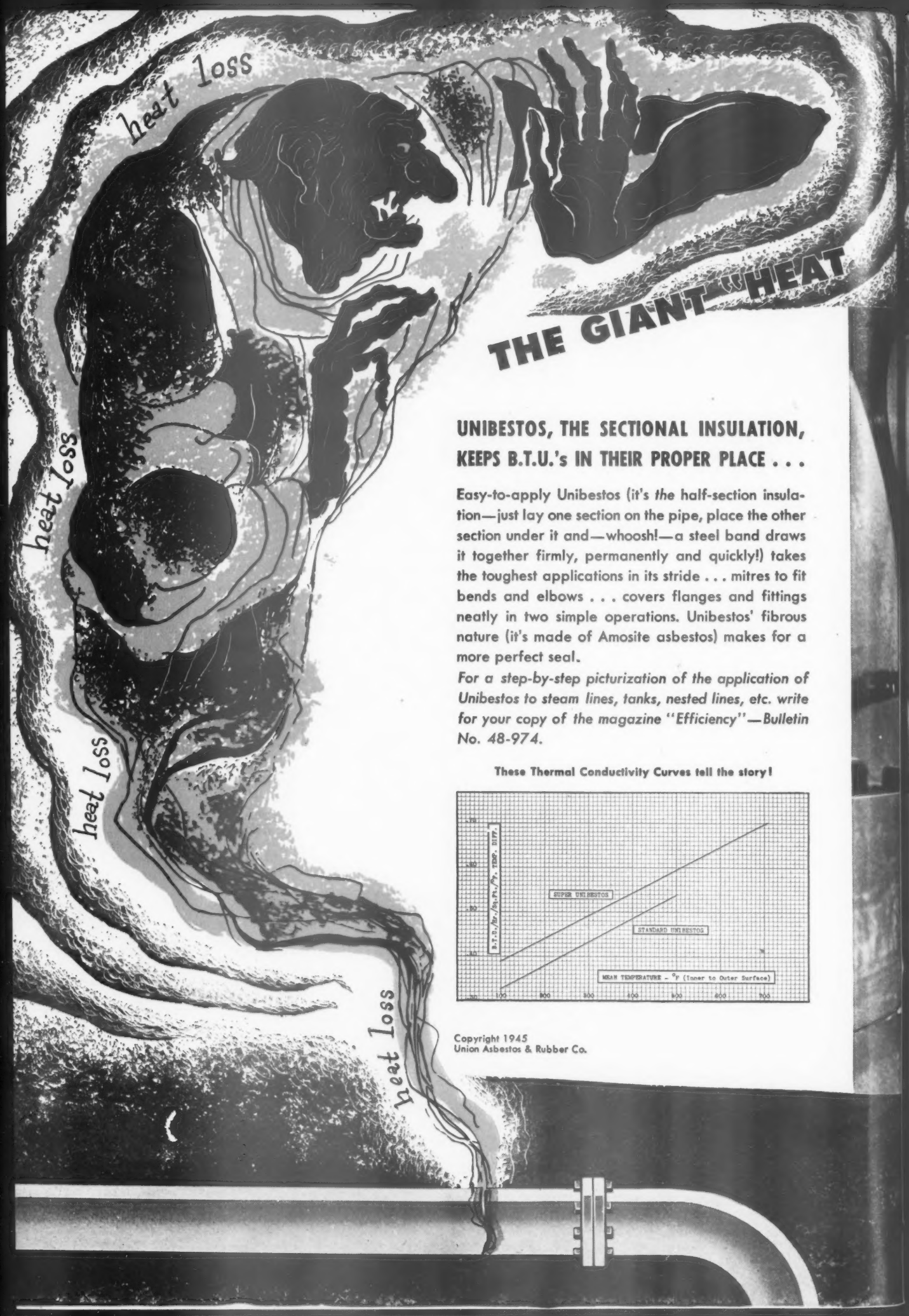
Turbine Engineers

Turbine engineers are reported by one of the members of the symposium, F. C. Lynn, as generally using neutralization number as a factor in determining when an uninhibited oil should be sweetened or discarded. In the case of inhibited oils, however, the test is not considered satisfactory because of the small change in neutralization number between the time the oil first is put into use and when the inhibitor has been consumed.

Lynn quoted one source commenting as follows on neutralization number of inhibited oils:

"We believe this test to be of little value to the laboratory or the operator as an indication of the oil's condition. The changes that occur in inhibited oils, even after years of operation, are so slight that they cannot be measured readily by this test. The interfacial tension test is capable of following these changes as they occur, and will predict a breakdown of the oil long before there is a change in neutralization number. In laboratories where equipment is not available for making this test, we believe the saponification number to be a good substitute as there is direct correlation between this value and interfacial tension."

Other tests cited by Lynn as "used with a greater feeling of security" than neutralization number of inhibited oils included: precipitation number, peroxide content, viscosity increase (indicating



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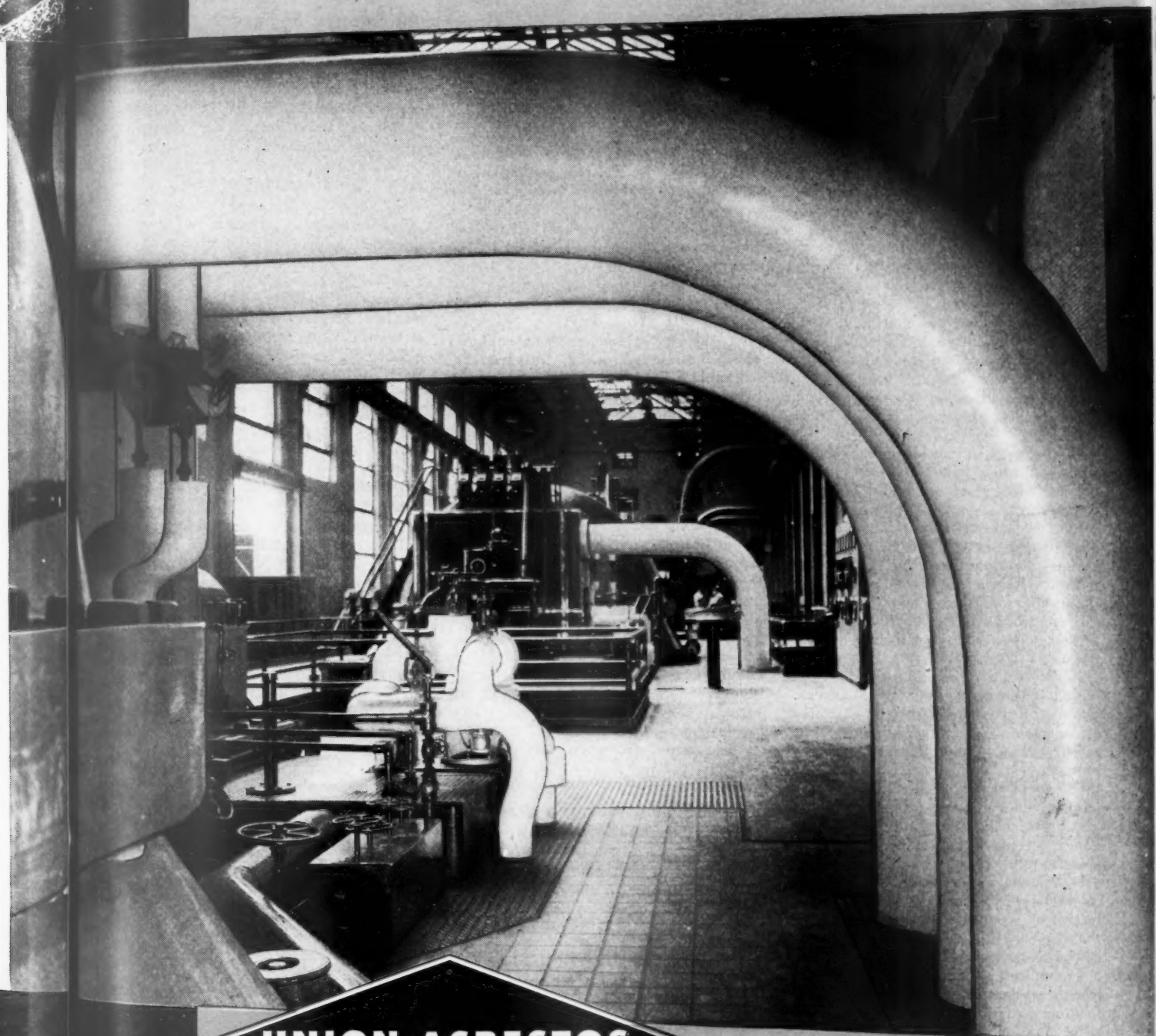

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TABLE 1—Used Oil Analyses and Condition of Engine Parts

Lubricant	A	B	C	D	E
Type	20-W Medium Quality	10-W Highly Refined	B Oil Plus Inhibitor	B Oil Plus Detergent	B Oil Plus Inhibitor & Detergent
Miles	2000	2000	4000	3000	4000
Neutralization Number	0.66	7.70	0.46	9.70	0.22
Naphtha Insoluble	1.07	0.99	0.48	3.41	0.38
Chloroform Soluble	0.87	0.45	0.11	1.75	0.08
Viscosity Increase at 100 F.	——	174	12	334	12
Engine Condition	Very dirty	Fair	Clean	Clean	Clean
Pistons	Stuck	Stuck	Free	Free	Free
Varnish	Dark	Trans-parent	Nil	Nil	Nil

formation of non-corrosive acids which will ultimately result in sludge formation), color, emulsion tendencies, sludging tendencies, periodic determination of corrosive and noncorrosive acids in the oil, and periodic oxidation tests (as in procedure reported by A. S. T. M. Technical Committee C-3) to determine remaining inhibition period.

Greatest need of turbine engineers, according to reports appears to be for tests which can be used both by the oil supplier and user in periodically determining the useful life remaining in an oil. In this connection, Technical Committee T-3 is reported studying modifications of present oxidation tests.

Another symposium member speaking for turbine engineers, G. H. Von Fuchs, stated:

"If we were to choose among existing, well-established laboratoryy tests to determine the end of the useful life of an oxidized oil, as in the proposed test for oxidation characteristics of steam turbine oils,[3] or in service, you would find the saponification number to be far more significant. However, it is unlikely that any single oil property can take the place of the neutralization number in its various present applications and mis-applications."

According to this authority, since oxidation is the major cause of oil deterioration, with peroxides, free and combined acids, oil soluble resins and sludges representing different stages in the process, the real interest is in the effect oxidation products have on oil performance. The harmful effects of oil oxidation in turbines stem from poor demulsibility, tendency to foam and sludge formation; these in turn are believed caused by soaps of the acids rather than the free acids themselves. However, he stated, the effective or harmful concentration of these soaps is usually so low that neither a conventional neutralization number nor a saponification number is able to detect them; hence direct tests for emulsion, foaming and sludging tendencies are far more significant.

Of the tests now available to examine oils, in the group opinion discussed by Mr. Von Fuchs, perhaps the best one is the present turbine oil stability test if modified to include appearance of the oil and catalyst coils in addition to neutralization or saponification number. In commenting on the stability test, this authority made the following points:

"The Turbine Oil Stability Test[4], has been designed to evaluate the prospective service performance of turbine oils. With this purpose in mind, the test is conducted in the presence of oxygen, water and metal catalyst. The test is ended when the oil reaches a neutralization number of two (selected as the criterion most generally accepted in turbine oil service, while the value of two represents a compromise concerning both conventional and oxidation inhibited oils). When rust and oxidation-inhibited oils are observed during this test, remarkable differences become apparent which do not express themselves in neutralization number values.

"Some oils discolor badly, carry rust in suspension, or start to form aqueous sludge soon after the start of the test. In many such cases the catalyst coils are attacked. The copper coil becomes coated with sludge while the iron coil disintegrates and the aqueous phase becomes clogged with rust. In other cases, the oil foams badly. While to all outward appearances such an oil would be unfit for service, the test may continue for many thousands of hours before a neutralization number of two is reached. In certain cases not even a saponification number (determined on a filtered oil sample) shows any indications of oil breakdown.

"The same oils which cause severe rusting in this test will pass the A.S.T.M Turbine Oil Rusting Test (D665-44T when new. Obviously in their present form neither the Turbine Oil Oxidation Test nor the Rusting Test gives a true prediction of oil performance in service. That this is so is evidenced by field experience, and is the reason for the reluctance of power plant operators to accept these tests in their oil specifications."

Automotive Engineers

Among industrial groups concerned with lubricating oils, the greatest confusion in interpretation of neutralization number seems to exist among automotive engineers, according to the survey of automotive engineers conducted by H. R. Wolf and reported at the symposium. Speaking of this group he states:

"Mechanical engineers are interested in neutralization number only as a means of predicting performance or explaining failures that have occurred. This group is generally rather hazy as to the meaning or significance of neutralization number. These engineers generally think of neutralization number as a term that reflects the corrosive tendency of an oil. Some in this group insist that neutralization number, in order to be of value to the engineer, must be a quantitative measure of corrosion, and must be expressed as a go or no-go dimension or property of an oil in the same manner as the diameter or hardness of a piston pin."

The lack of correlation between neutralization number of the oil in service and the condition of the engine in which the oil was used is further confusing to the engineer. If the used-oil analysis data given in Table 1, (from the Wolf paper) were used as basis of evaluating engine condition, it is entirely probable that oil "D" would be reported as poorest of the five oils and certainly inferior to oils "C" and "E", it is pointed out. However, considered on the basis of the actual engine condition and with preknowledge of oil composition, oils "C", "D" and

TABLE 2—Analyses of Two Different Oils Operated in Same Type of Gasoline Engine Equipment under Same Type of Normal Road Operation

10-W Penn. Oil Without Additive

Miles	Neut. No.	Naph. Insol.	Chlor. Sol.	Con. Car.	Ash
0	0.04				Nil
1074	0.45	0.94	0.24	1.00	0.19
1620	0.78	0.92	0.26	1.33	0.19
2266	0.80	1.55	0.34	1.92	0.44
2413	0.95	1.21	0.29	1.87	0.46
4470	0.97	2.67	0.42	3.18	0.76
4948	1.14	2.02	0.45	2.29	0.51

Naphthenic Oil With Additive

Miles	Neut. No.	Naph. Insol.	Chlor. Sol.	Con. Car.	Ash
0	1.21				0.35
449	0.83	0.42	0.16	0.58	0.38
1188	1.09	0.59	0.16	0.80	0.50
1690	1.24	1.31	0.23	1.19	0.57
2262	1.24	1.13	0.21	1.52	0.88
2724	1.14	1.15	0.18	1.82	0.82

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TABLE 3—Analysis of Six Oils Run in GM "71" Diesel Engine in Substantial Accord with L-4 Test Procedure.

Test	Hours	Neutralization Number	Naphtha Insoluble	Chloroform Soluble
1	8	0.50	0.17	0.06
	55	0 82	0.34	0 16
	116	2.14	3.06	2.26
2	25	0 64	0 15	0.24
	68	2.58	3.18	2.83
	91	3.44	6.98	6 24
3	24	0.11	0.33	0.07
	72	0.38	1.07	0.40
	96	0.43	3 04	1.60
4	100	0.16	0.19	0.05
	205	0.26	0.18	0.03
	305	0.42	0.52	0.11
	501	0.54	0.11	0.03
	757	0.59	0.16	0.05
5	97	0.16	0.30	0.08
	206	0.22	0.38	0.05
	353	0.16	0.33	0.08
	530	0.21	0.44	0.09
6	96	0.11	1.02	0.54
	192	0.16	0.10	0.05
	312	0.16	0.09	0.04
	408	0.22	0.12	0.05
	500	0.22	0.28	0.13

"E" would be rated as much superior to "B", while "A" would be labeled the poorest of the oils tested.

Thus to the first group, interested solely in design and manufacture of automobiles, neutralization number is of no value. It is shown by Mr. Wolf, however, that the test value is of interest to the second group—service engineers—providing information concerning type and composition of base oil and addition agents is available.

In table 2 (from the Wolf paper) is reported the analysis of two oils operated in the same type of gasoline engine equipment under essentially the same type of normal road operation. The table shows that neutralization number of the uninhibited oil increased rather rapidly through the first part of the test but more slowly during the last half, reaching a maximum at the end of the test. It also shows higher value for neutralization number of the unused additive-oil than that of the used uninhibited oil. During the first part of the test with the additive-oil, the neutralization number dropped, indicating consumption of additive; gradually building up at the end of the test to near its original magnitude. This is explained by the addition of additive with make-up oil and to some extent by formation of some organic acid from oxidation of the base oil.

Such data as these are particularly valuable to the engineer in following the changes that take place in service. However, by itself the information is not of value without knowledge of the type of oil and additive involved.

This is further illustrated in Table 3 (from the Wolf paper) which shows an analysis of oils run in six heavy-duty oil evaluation tests. The data show neutralization number increasing rapidly in the first two tests, terminated at 116 and 91 hours, respectively. Engine examination revealed excessive bearing corrosion and engine deposits. The third test was terminated at 96 hours because the engine failed from excessive piston deposits. The oil did not oxidize to the extent shown in the first two tests yet the build-up in neutralization number is observed. In the last three tests, however, there is no suspicious increase in neutralization number and upon examination the engines were found to be in excellent condition even though in the last test the engine operated for the first 144 hours without a sludge filter, accounting for the high naphtha insoluble reported in the 96-hour sample.

It would appear from the survey data presented at the symposium that industry in general is not very familiar with service behavior of additive-type oils, and there is a very real danger that through misunderstandings, neutralization number specifications may become sufficiently restrictive to constitute a barrier to adequate development of these heavy-duty oils.

It has been demonstrated that neutralization number is an inadequate criterion for predicting useful life of oils containing additives, especially oxidation inhibitors. Thus the industrial consumers' real need is for a test permitting accurate prediction of useful service life.

Some test similar in scope to the presently proposed Oxidation Stability Test for Turbine Oils but which will correlate reasonably well with observed engine conditions, is generally needed to take the place of neutralization number. However, it is unlikely that any laboratory test will be developed in the near future which will supplant, for development purposes, service tests similar to those required under Army-Navy specifications for engine oil evaluation. Neutralization number may well be used as one of the criteria in assuring uniformity of product.

References

(1) Symposium on Neutralization Number, Winter Group Meeting of Committee D-2, A.S.T.M., Detroit, Jan. 15, 1945.
(2) *NPN Technical Section*, 35, No. 5, R-90-91 (1943)
(3) *A.S.T.M. Proceedings*, 43, 275-280 (1943)
(4) *Ibid.*, p. 275

Charts Show Viscosity and Oxidation Changes In Used Crankcase Oils

By C. M. Larson
Chief Consulting Engineer, Sinclair Refining Co.

THE lubricating oil of internal combustion engines fuel powered by gasoline or Diesel fuel, changes viscosity either by (1) a loss through dilution caused by fuel blow-by, fuel leakage, or by (2) an increase through oxidation caused by excessive crankcase temperatures over extended periods of usage.

The loss of viscosity through dilution is far greater with equal parts of gasoline than for equivalent parts of Diesel fuel. Chart 1 covers dilution and oxidation changes in viscosity for gasoline engine lubricating oils during service, whereas Chart 2 covers the same factors in Diesel engine service. Oxidation is based on percentage viscosity increase, which percentages are common to both charts. However, in service the rate will differ.

The Viscosity Dilution and Oxidation Chart, without the oxidation increases, was orginally developed for the Navy Diesels and later adopted for the railroad Diesel locomotive engines. By the use of a viscosity comparator instrument, reading Saybolt seconds direct at 100°F., a simple means is offered to the operator or maintainer for checking these viscosity changes of used oils.

Chart 1 is now made available for gasoline powered equipment which makes it possible to determine whether the engine is operating too cold or too hot. If operating too cold, dilution will occur, and if too hot oxidation will take place.

Examples for using each chart are given below:

Gasoline Engine Oils

Dilution

Given: Saybolt Universal Viscosity of the new gasoline engine lubricating

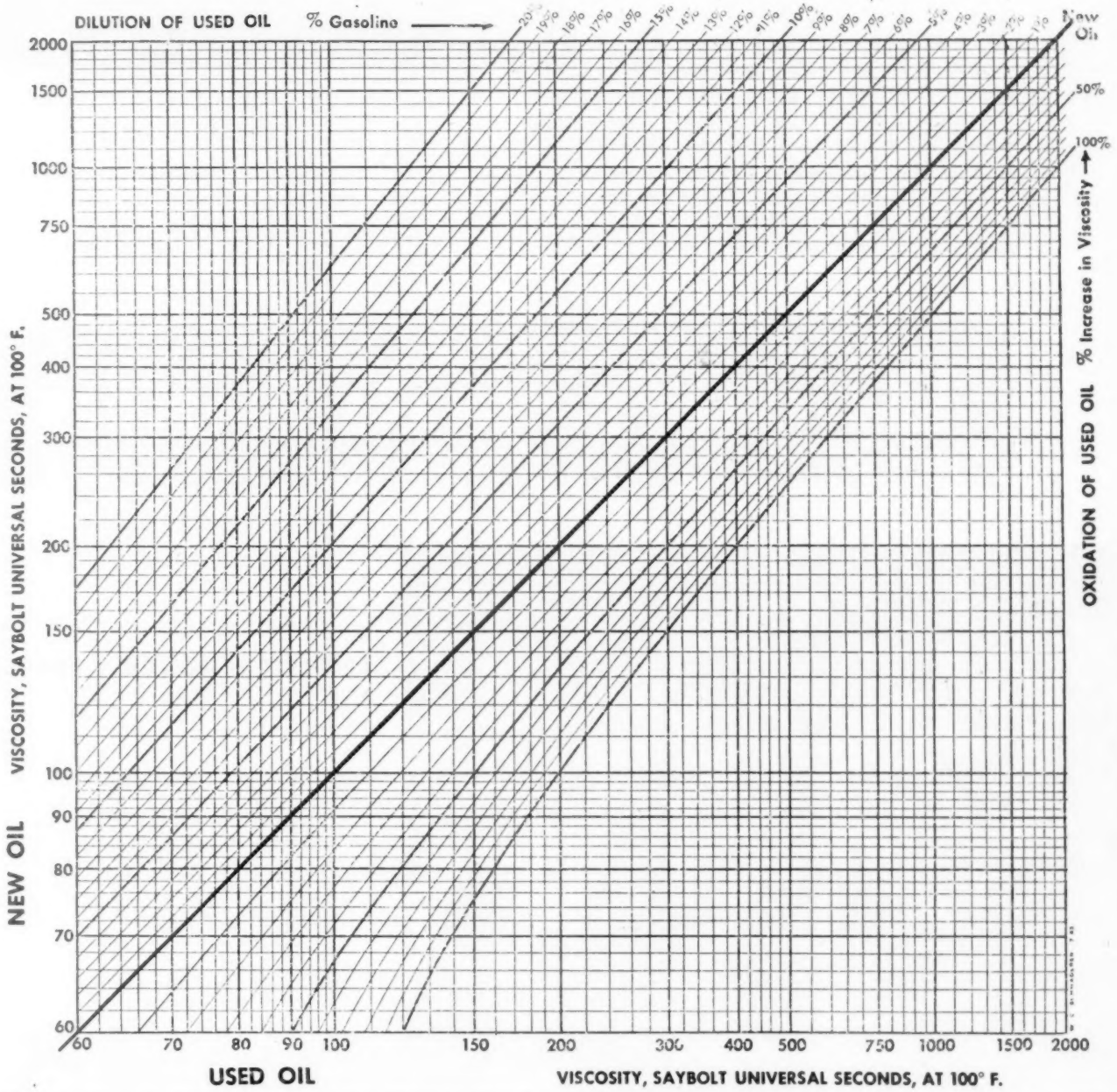

Chart 1—Viscosity Dilution and Oxidation Chart for Gasoline Engine Oils for checking dilution of used gasoline engine lubricating oils and oxidation of all types of used oils

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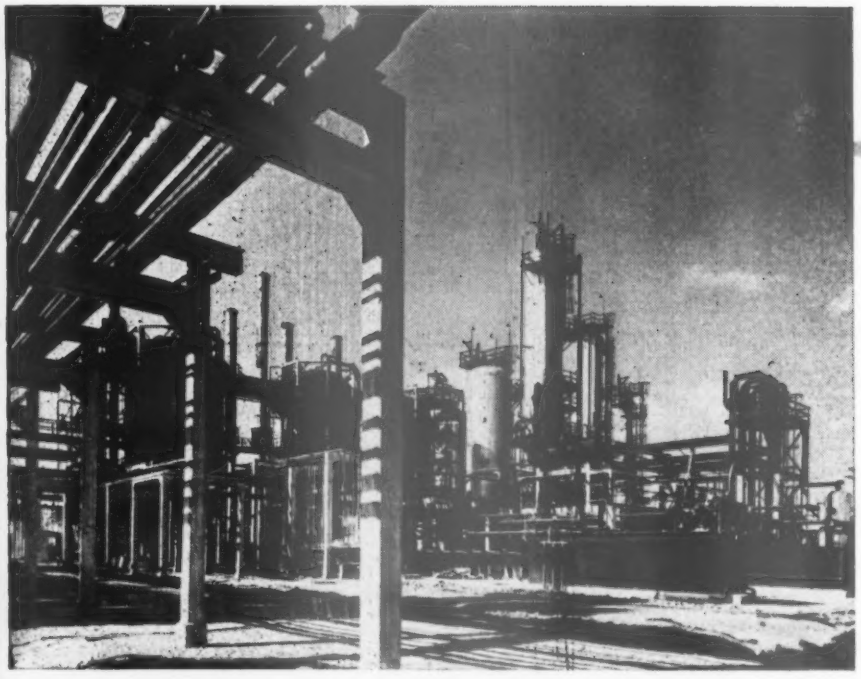

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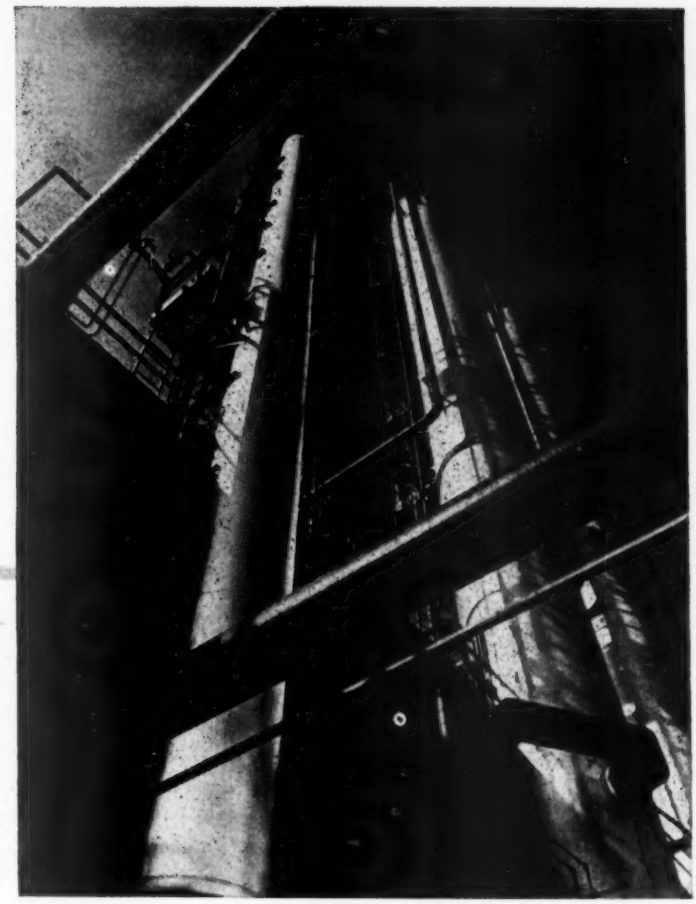

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oil, at 100°F.=500 sec. and Saybolt Viscosity of the used oil, at 100°F.= 360 sec.

Required: Percentage of dilution of used oil.

Solution: Locate the two given viscosities on their respective viscosity scales. The 500 sec. point is located on the left viscosity scale at 100°F. Saybolt Universal for the new oil and the 360 sec. point on the bottom viscosity scale for the used oil. Project this 360 point vertically upward until it meets the horizontal projection from left to right of the located 500 point. Either mark this point or let the pencil point rest there. Read the percentage of the upward sloping line passing through the obtained intersection point on the top scale. Thus it will be found that the used oil shows a 3% dilution.

Oxidation

Given: Saybolt Universal Viscosity of the new gasoline engine lubricating oil, at 100°F=500 sec. and Saybolt Universal Viscosity of the used oil, at 100°F.= 600 sec.

Required: Percentage of increase in viscosity of used oil.

Solution: Locate the two given viscosities on their respective viscosity scales. The 500 sec. point is located on the left viscosity scale at 100°F. Saybolt Universal for the new oil and the 600 sec. point on the bottom viscosity scale for the used oil. Project this 600 point vertically upward until it meets the horizontal projection from left to right of the located 500 point. Either mark this point or let the pencil point rest there. It will be found that the obtained intersection point falls on the 20% sloping line using the right hand scale. Thus the increase in viscosity of the used oil due to oxidation is 20%.

Diesel Engine Oil

Dilution

Given: Saybolt Universal Viscosity of the new diesel engine lubricating oil, at 100°F=550 sec and Saybolt Universal Viscosity of the used oil, at 100°F = 480 sec.

Required: Percentage of dilution of used oil.

Solution: Locate the two given viscosities on their respective viscosity scales.

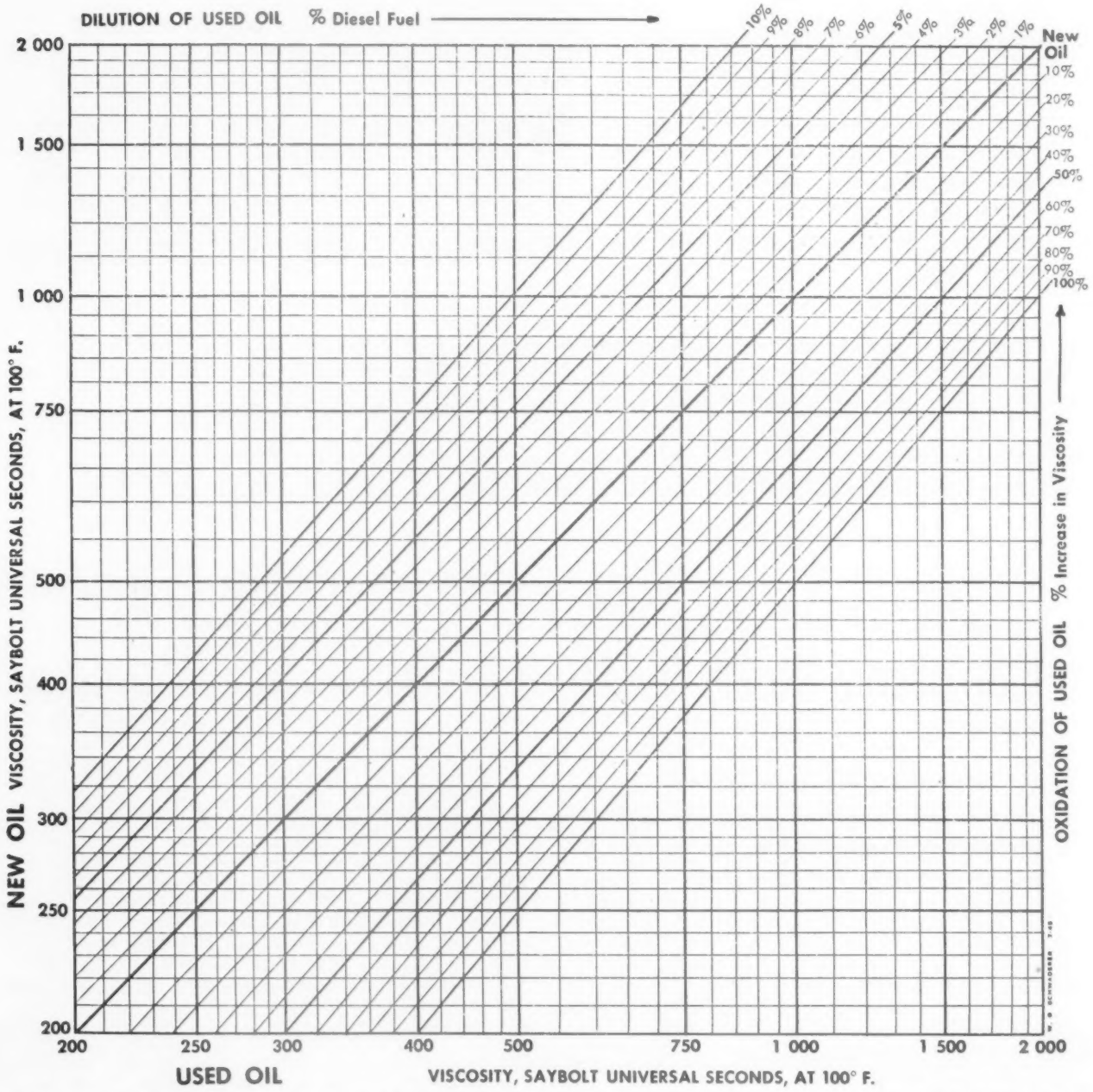

Chart 2—Viscosity Dilution and Oxidation Chart for Diesel Engine Oils for checking dilution of used Diesel engine lubricating oils and oxidation of all types of used oils

Charts Show

The 550 sec. point is located on the left viscosity scale at 100°F. Saybolt Universal for the new oil and the 480 sec. point on the bottom viscosity scale for the used oil. Project this 480 point vertically upward until it meets the horizontal projection from left to right of the located 550 point. Either mark this point or let the pencil point rest there. Read the percentage of the upward sloping line passing through the obtained intersection point on the top scale. Thus it will be found that the used oil shows a 2% dilution.

Oxidation

Given: Saybolt Universal Viscosity of the new diesel engine lubricating oil, at 100°F=400 sec. and Saybolt Universal Viscosity of the used oil, at 100°F= 460 sec.

Required: Percentage of increase in viscosity of used oil = ?

Solution: Locate the two given viscosities on their respective viscosity scales. The 400 sec. point is located on the left viscosity scales at 100°F. Saybolt Universal for the new oil and the 460 sec. point on the bottom viscosity scale for the used oil. Project this 460 point vertically upward until it meets the horizontal projection from left to right of the located 400 point. Either mark this point or let the pencil point rest there. It will be found that the obtained intersection point falls halfway between the 10% and 20% sloping line using the right hand scale. Thus the increase in viscosity of the used oil due to oxidation is 15%.

TECHNICAL MEETINGS FOR OIL MEN

NOVEMBER

6-7, Society of Automotive Engineers, Fuels and Lubricants Meeting, Mayo Hotel, Tulsa.

12-15, American Petroleum Institute, Silver Jubilee and Annual Meeting, Stevens Hotel, Chicago.

30-Dec. 1, Society for the Advancement of Management, Annual Conference, Waldorf-Astoria Hotel, New York.

JANUARY

7-11, Society of Automotive Engineers, Annual Meeting and Engineering Display, Book-Cadillac Hotel, Detroit.

FEBRUARY

25-Mar. 2, 50th Exposition of Chemical Industries, Grand Central Palace, New York.

APRIL

3-5, Society of Automotive Engineers, Aeronautic (Spring) Meeting, New Yorker Hotel, New York.

17-19, Natural Gasoline Association of America, Annual Convention, Baker Hotel, Dallas, Texas.

18-19, National Petroleum Association, Semi-Annual Meeting, Hotel Cleveland, Cleveland.

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7-9, National Association of Corrosion Engineers, Annual Meeting, Presidential Hotel, Kansas City, Mo.

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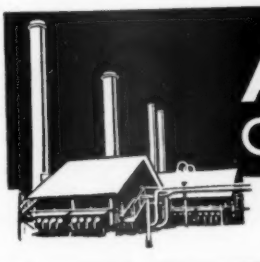

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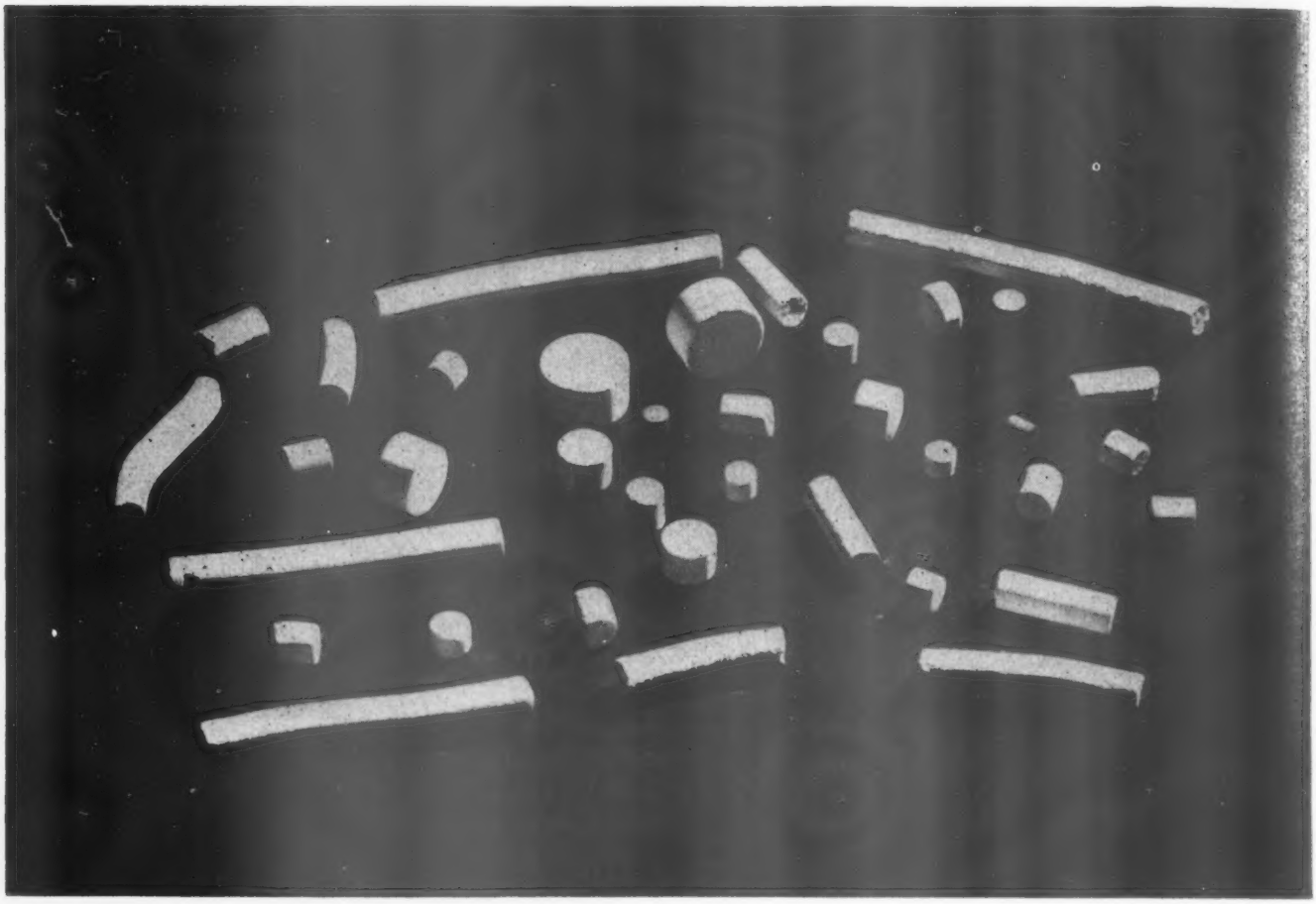

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Fifth Instalment

P.A.W. Refinery Inspection Manual

Part 2—Electrical Equipment

Methods for the inspection of turbines, generators, motors, instruments and other refinery electrical equipment, together with their auxiliary equipment, are presented in this instalment of the Petroleum Administration for War Manual, "Wartime Recommendations for Refinery Inspections". A brief discussion on the determination of safe operating limits for electrical equipment is included.

Part 2 of the Manual, Electrical Equipment, is complete in this instalment. Part 3, Instruments, and Part 4, Fire Protection Equipment, will appear in later issues. Part 1, Process Equipment, was published in the four preceding instalments.

While originally prepared for the benefit of refineries in the wartime program by a group of government and oil company refinery engineers, the value of the manual in inspection work in refineries generally has been recognized. It is therefore being published in the NPN Technical Section. Reprints are available to oil companies as set forth on another page.

200. Introduction

It is assumed that the equipment on old installations was of the best design available and in accordance with the best engineering practices at the time of installation. Selection in the future should follow the recomendations and specifications set forth in the Manual of Electrical Practice for Petroleum Refineries now being prepared by a subcommittee of the A.P.I.

It is also assumed that installations, both old and new, are or were in accordance with the latest editions of the National Electrical Code. Those not specifically covered therein are taken to be in accordance with the best practices then current.

Wiring and installation of equipment must comply with any applicable local or state ordinance differing from that code.

This manual is intended as a guide for the inspection of refinery electrical equipment with proper maintenance practice as its objective. It is recognized that, as the design of the equipment changes and the art of the industry progresses, some sections of the manual may not apply. Such deviations should be left to the discretion of the inspection supervisors.

SECTION 1—Scope

211. General Statement

The purpose of this part of the manual is to consider the inspection of all electrical equipment in refineries from the standpoint of continuity of service and the protection of individuals and property. The frequency and methods of inspections will vary for each general class of equipment, depending on the service expected and whether equipment can be available for such inspections without interruption to service or jeopardizing the safety of individuals responsible for inspection and maintenance. Those responsible for the inspection and maintenance of electrical inspection will also be outlined in detail in Section 2, under the caption of "Organization."

The recommended practices for the inspection of each general classification of electrical equipment will be outlined in detail under Section 3, "Description of Inspection Methods."

SECTION 2—Organization

221. Responsibility For Inspection

The head of the electrical department is responsible for the proper inspection and maintenance of electrical equipment. The selection of men best qualified to handle work under the above classifications is also his duty.

Electrical departments of large plants usually are headed by an electrical engineer, assisted by a chief electrician and sub-foremen in charge of special departments. Many highly specialized phases of this work require men of years of experience who are particularly qualified to handle certain features of inspection and maintenance.

222. Qualifications

Because particular qualifications and experience are requisite for special assignments, the selection of the man to fit the job is most important. The personnel of an electrical department may be considered specialists, and men may be needed who are qualified to handle various types of work such as: Control wiring, including relay, meter and instrument work; pole line work; underground and duct work; telephone and annunciators; armature and shop repair work; and special equipment and wiring system work.

SECTION 3—Inspection Methods

231. General

The methods of inspection involved will depend on the type of equipment, the importance of continuity of service and the particular classification of that section of the plant where the equipment is operated. The word "classification" as applied would mean whether the area or location is considered as hazardous, semi-hazardous or non-hazardous. It can readily be seen that the methods of inspection will vary considerably, depending on the voltage of the equipment, its location, and whether the installation or continuity of service are such as to permit periodical inspection without possible hazard to persons or property.

Outlined below are the methods and frequency of inspections that would apply for the general classifications of electrical equipment installed in refineries.

232. Power Plant, Substations

232.01—Continuity of Operations. The continuity of operations of generating stations and substations is well recognized because all the electrical utilization equipment in a refinery depends on it for continuous operation. For this reason, it is essential that very careful consideration be given to the selection of equipment from the standpoint of inspection or maintenance under operating conditions.

Power plants and station equipment are usually under the supervision of experienced operators and, in order to maintain uninterrupted service, this equipment is under the eyes of an inspector every minute as a routine duty. The bearings are checked, the pressures are continually watched, load conditions are noted on generator and feeder circuits, and a log of conditions is kept for each hour.

232.02—Turbo Generator

232.02 (a)—Turbines. Turbines should be watched closely, particularly when they have been in operation for a long time and there is a tendency toward a reduction in capacity as a result of scale deposit or sludge due to carryover in the steam. Turbines are effectively backwashed to improve these conditions if the formation is in the form of a sludge rather than a scale deposit. The overspeed tripping devices, both electrical and mechanical, should be tripped once every three weeks or once a month. The turbine oil is also checked periodically

as to quality, and should be purified once in every three or four weeks.

232.02 (b)—Generators. Turbo generators are normally brought down for general inspection or repairs every 18 months or two years, depending on the type of machine, operating duty, and whether there were any indications that abnormal conditions exist.

232.02 (c) — Mechanical Inspection. During this inspection both generator and turbine are dismantled to the extent that a complete inspection can be made, usually under the supervision of a factory service engineer. The bearings, spindle, blading for all stages and clearances between rotor and stator are inspected. Necessary repairs are made and if any noticeable wear is detected conditions are corrected or arrangements made for replacement parts. Repairs are made at the next down period if conditions permit.

232.02 (d)—Electrical Inspection. An insulation test is made of the stator windings and the condition of the coils is noted. The windings are blown out, and, if necessary, the coils are painted with an insulating varnish. The collector rings and exciter commutators are cleaned or redressed, if required.

232.02 (e)—Cleaning. The tubes in the air cooler and condenser, if of a condensing type, are checked to determine if any corrosion or erosion is taking place and tubes in bad condition are replaced. The tubes are also checked for deposits, and are thoroughly cleaned either by washing or turbining, depending on whether the deposit is a sludge or scale formation. In other words, the inspection and repairs at these down periods are such that under normal conditions the equipment will operate continuously until the next down period, which may be 18 months or 2 years later.

232.03—Main Switchgear. The main switchgear should have been selected so that the contacts, oil and operating mechanism can be readily inspected. The circuit breakers should be inspected at least every year or possibly every six months depending on the severity of its service. Contacts are dressed up or replaced as required. The oil should be checked for dielectric strength, color and whether there is any sludge deposit due to decomposition.

232.04—Protective Relays. The protective relays should be checked periodically to simulate short circuit or overload conditions. The wiring of the control panel should be visually inspected and contacts cleaned, if necessary.

232.05—Auxiliary Switchgear. The switchgear for the auxiliaries should be subjected to the same class of inspection, for it is just as important from the standpoint of continuity of service to have the auxiliaries in first-class condition as the major operating equipment.

232.06—Substations. If a power plant is operated in conjunction with a high tension substation, the temperature of the transformer should be closely observed when operating under practically full load conditions. The oil should be tested at least every two months for dielectric strength, and if the tests show a fairly low voltage breakdown, the oil should either be changed or filtered.

232.07—Insulators etc. The insulators, supports, lightning arresters, etc. on substation equipment should be inspected at regular intervals. If an oil circuit breaker of an outdoor type is used with these transformers, the same class of inspection should apply as for the main switchgear outlined above.

232.08—Other Equipment. All other equipment such as station transformers, small drives, contactor panels, batteries, charger set, etc. should be rigidly inspected periodically. The emergency lighting or station generator should be checked approximately every month to insure good operating condition, so that in the event of an emergency there is no question about its functioning properly. Inspection of ground connections is essential to insure a good ground circuit for protection from the standpoint of safety to equipment, operators and inspectors.

233. General Wiring

233.01—Electrical Conduit. The use of conduit for wiring is more or less standard practice in refineries and should be in accordance with the National Electrical Code. In hazardous locations, conduit and approved fittings should be used exclusively with conduit runs to equipment properly sealed, while in non-hazardous locations, pressed steel enclosures and standard fittings are permitted. Conduit should be inspected periodically to see that it is properly supported to prevent breakage of fittings. Inspection should also be made to see that covers are in place and that there is no moisture oil or water in the conduit. If temporary wiring is necessary, this wiring should be properly supported and clearances provided to prevent personal injury.

233.02 — Distribution and Lighting Panels. Distribution and lighting panels should be inspected to see if fuse or breaker contacts are overheating due to possible poor contact or overload. Contacts should be dressed up or replaced in cases where excessive heating has caused them to lose their tension. Trouble caused by poor contact can be eliminated by silver plating. The overheating of the contacts may be due to overload, in which case load tests should be made, and the conditions corrected as might be necessary. Overheating may result in the wire insulation becoming brittle and eventually requiring replacement.

233.03—Grounding of Wiring Systems. All cabinets, switches, contactors, etc. should be properly grounded, and bonding jumpers installed around pressed steel enclosures where connections are made by means of lock nuts and bushings and the circuit voltage is in excess of 125 volts. For protection of electrical installations, grounding should be in accordance with Article 250 of the National Electrical Code. Inspections of electrical equipment should cover such items as proper grounding and bonding connections.

233.04—Painting. All equipment and conduit should be painted to prevent deterioration, particularly equipment exposed to the weather.

234. Motors

234.01—General. Motors most extensively used for refinery drives are squirrel cage induction motors. However, slip ring and synchronous motors are used for special applications. Motors generally give very little trouble, but require some attention, such as lubrication, a check of the bearings, and air gap clearances between the stator and rotor.

234.02—Lubrication. Proper lubrication is very important, whether the motor is equipped with sleeve bearing or ball bearings. Some trouble has been experienced with grease lubricated bearings in high speed motors as a result of operators filling the bearings too full. Too much grease is as bad from a lubricating standpoint as too little. Maintenance men should be instructed to follow the manufacturer's recommendations in properly lubricating grease lubricated bearing motors. Under normal conditions, new grease should not be added to the bearing more frequently than once every six months, at which time bearings should be washed out with kerosene, thoroughly cleaned and filled with new grease. With oil lubricated bearings, it is satisfactory to add new oil in order to maintain a proper oil level, but every six months the bearings should be thoroughly cleaned and the oil completely replaced.

234.03—Overheating. If motors continually run hot, it is advisable to make a test of the motor to determine the load conditions. The heating up of the motor may be due to increased brake H. P. requirements of the particular drive, dirt in the motor preventing proper ventilation, or to improper air gap clearance between rotor and stator brought about by worn bearings. The inspection should be continued until, by process of elimination, the trouble is located.

234.04—Cleaning and Drying. If the motor needs cleaning, and is not too large, it is advisable to take the motor through the shop for cleaning, baking and painting, together with such other repairs as are required. If this is not practicable, due to its size, it should be possible to make the same repairs on

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the job. The drying operation is sometimes very difficult but can be accomplished by passing current through the windings with a voltage low enough to prevent excessive heating or by the use of portable infra-red ray lamps. The motor should be covered with a tarpaulin to retain the heat, but the temperature should be watched so that it will not exceed 90°C. The motor should be painted when thoroughly dried, and the number of coats of insulating paint will depend on the conditions under which the motor operates.

234.05—Frequency of Inspection. The frequency of inspections outlined above depends on the location of the motor, (whether exposed to a damp or dusty condition etc.), and the continuity of service expected. All motor insulation should be tested periodically with a megger at frequent intervals to insure against failure of windings.

234.06—Protective Devices. Protective devices should be carefully checked to insure protection of the motor from overheating and short circuit conditions. The inspection that should apply will be furnished under a separate caption of "Motor Control Equipment."

234.07—Grounding. Motors should be inspected periodically to see that the equipment is properly grounded and that all ground connections are in first-class condition.

235. Motor Control Equipment and Protective Devices

235.01—General. Motor controls, as commonly used in oil refineries, serve two main purposes: first, to start and stop the motor and, second, to protect the motor from electrical damage. In order to perform these functions properly the controller contacts and oil must be in good condition and the overload and low-voltage trips must be in adjustment.

235.02—Contact Inspection. The adjustment of the trips usually causes little trouble, so the major share of the inspection work should be devoted to the contacts and the oil of the controller. The contacts should be inspected visually for indications of burning and mechanical damage. The contact area is very important in this type of equipment and should be determined carefully with feelers.

235.03—Oil Inspection. Preliminary inspection of the oil may be visual. A sample drawn into a clean bottle should be examined for evidence of moisture, cloud and sludge. If this inspection indicates contamination or breakdown of the oil, a test should be made to determine whether the dielectric strength is up to specification.

235.04—Frequency of Inspection. The period between inspections depends on the service of the controller and the importance of the equipment involved. Where motors are on automatic control and are started and stopped frequently, the starting equipment should be inspected often and regularly. Important motor drives should also be given special attention, but inspection is usually possible only during shutdown periods.

235.05—Sizing of Breakers. The selection of equipment from the standpoint of adequate interrupting capacity is very important, and breakers that show signs of excessive mechanical injury should be carefully investigated. It is possible that conditions of this nature can only be corrected by the replacement of existing breakers with breakers of a higher interrupting capacity. The size of breaker will depend on the amount of fault current it will have to interrupt and that depends on the source of power supply, installed generating capacity on the system, and the distance from the source of supply.

235.06—Inspection of Protective Equipment. The protective equipment, whether it be fuses or relays, is not as common a source of trouble as the motor controls, but they cannot be completely neglected. All equipment of this kind should be given a regular visual inspection to detect any mechanical damage or obvious electrical trouble.

235.07—Use of Cycle Counters. On important circuits a complete check of the relay and circuit breaker operation should be made, using a cycle counter if available. The frequency of these checks can best be determined by experience and must depend on when the breaker can be opened without dropping the load.

236. Lighting Equipment

236.01—Illumination. Proper illumination of refinery equipment is very important both from the standpoint of possible hazard and to provide proper lighting around working areas. Good lighting is mainly a question of distribution and elimination of glare. Permanent lighting installations should be made and the use of makeshift arrangements such as portable cords or use of temporary wiring should be discouraged except in emergency.

236.01 (a)—Lighting Intensity. The amount of lighting intensity depends on the class of work performed. Table 1 may be used as a guide in checking lighting installations to determine the adequacy of illumination. The table does not include all locations in a refinery, but can be used as a guide for other areas and locations. If areas are found to be inadequately illuminated, install either more fixtures, larger wattage fixtures or different type of fixtures that would be more suitable from the standpoint of distribution.

TABLE 1—Lighting Intensity for Refinery Locations

Location	Foot Candles
Control or Pump Rooms (General)	8-10
Control or Pump Rooms (Control Panel or Desk)	25-40
Boiler Houses	5-8
Power Houses (General)	10
Power Houses (Instrument Panels, etc.)	25-40
Warehouses (General)	5-8
Operating Units	3-5
Operating Areas	1-2
Office Buildings	30-40
Shops (General)	5
Shops (Benches)	10-12
Shops (Certain Machines)	30-50
Docks and Manifolds	2-3

236.02—Cleaning Frequency. Reflectors or fixtures should be cleaned periodically, depending on the conditions to which the lighting equipment is subjected, such as dust, vapor, oil, etc. Cleaning of fixtures will greatly increase the efficiency of the units.

236.03 — Hazardous Locations. In hazardous locations, the lighting fixtures should be inspected to see that no globes are broken and that the guards are securely fastened. Where vapor-proof or explosion-proof fixtures are installed, it is necessary to see that the globes are tight. The worst hazard in this type of fixture is constituted by vibration loosening up the globes.

236.04—Inspection of Lighting Panels. Lighting panels should be inspected to see there is no excessive heating of fuse clips or breaker mechanisms due to poor contact or overload. Explosion-proof lighting panels should also be inspected for the above reasons and, in addition, to see that all conduit runs are properly sealed and the covers or compartments are securely fastened.

236.05—Portable Extensions. The use of portable lamps should be discouraged as far as possible for regardless of whether the best materials are used, there is always the possible hazard of mechanical injury. It is realized that under some conditions the use of extension cords is absolutely necessary. In such cases the materials used should be the best on the market and the extension cords subjected to the most rigid inspection. Schedules for inspection of extension cords will vary with different organizations, but due to their use as a possible hazard, a weekly inspection of all cords is recommended. The inspection as well as repairs should be done by the electrical department personnel fully qualified to do this class of work. Extension cords whether used with portable lamps, tools or appliances should

be carefully inspected to see that the grounding connections and equipment are in first-class condition.

236.06—Flashlights. Flashlights are used very extensively around a refinery. Flashlights approved by Underwriters for different services should be used, and particularly those approved for Class I, Group D locations when used in hazardous areas. In order to prevent any hazard in usage, they should be inspected in the same manner as extension cords.

237. Portable Electrical Equipment

237.01—General. The general use of portable equipment such as welding machines, pumps, compressors, etc. should be limited to certain areas, due to the possible hazards involved. Welding permits or use of other portable equipment in hazardous areas should be restricted and require the approval of a fire marshal or persons properly authorized to grant such permits. Every precaution should be exercised before permits are granted to see that the area or equipment is properly prepared for the safe operation of this equipment. These precautions may include the use of gas detectors, blinding off the lines, steaming out equipment, etc.

237.02 — Frequency of Inspection. Portable electrical equipment is subjected to rather rough usage due to its being hauled or pulled about the plant. This equipment should be inspected at frequent intervals to see that all anchor bolts are tight, electrical contacts are in good condition and the equipment is properly protected from the weather.

237.03 Grounding. Where outlet receptacles are available, an extra conductor of the portable cord should be permanently grounded through the extra pole of the receptacle to conduit system. This equipment should be permanently or temporarily grounded before being put into service, thereby avoiding the hazard to operator of possible accidental grounding. This phase should be very carefully inspected.

238. Signal and Communication Systems

238.01—General. Due to numerous contacts and delicate mechanisms in this equipment, routine inspection is very essential in order to keep it in first-class condition. Insofar as possible, location of telephones in hazardous areas should be avoided. Where unavoidable, proper precautions should be taken to protect the equipment, or suitable equipment for this class of service should be installed. Other inspections are more or less similar to those encountered in overhead and underground power systems.

239. Instruments

239.01 — Scope. Since the inspection of instruments has been discussed elsewhere, the only phase of instruments which will be covered here is the power wiring and necessary protective devices.

239.02—Power Supply. A large number of instruments are equipped with electric clocks for driving the chart or with electric motors for driving the operating mechanism. Most of these require either 110 V. or 220 V. supply. This power wiring should be protected with fuses, thermal cutouts or relays in the same way as lighting circuits and other similar equipment. The nature of the electrical installation will, of course, be governed by the location; that is, the extent to which the installation is made explosion-proof or vapor-tight will be determined by the degree of hazard in the location.

239.03—Frequency of Inspection. Inspection of this equipment must of necessity, be largely visual. When trouble is indicated by blown fuses or relay operations, the wiring should be carefully checked for grounds. Motors should be watched for overheating resulting either from overloading or bearing trouble.

2310. Overhead Power System

2310.01—General. It is not the intent to cover here the necessary safety precautions to be taken by linemen or electricians performing work on overhead systems. Complete detail requirements as generally recognized are given in the "National Electrical Safety Code" which should be strictly followed. The men assigned to this work should be equipped with all the latest safety devices to protect against live lines, as well as the usual equipment, such as safety belts, good climbers, rubber gloves, etc.

2310.02—Preparation of Equipment for Inspection. Wherever possible it is recommended that circuits be worked dead. On pole line work, it is recommended that at least two men be assigned to the work. The second man should be on the ground to act as a helper, and should be instructed to observe the linemen carefully and caution when necessary against coming in contact with live wires.

2310.03—Marking Protecting Equipment. All switches, fuses or other disconnecting means used for isolation should be properly marked and the "blocking system," described elsewhere in this manual, should be rigidly enforced to ensure that the line is de-energized throughout the inspection period.

2310.04—Pole and Cross Arms-Inspection. Periodic inspections should be made of poles and cross arms for assurance that they are not deteriorating to a point where they are likely to fail. Inspection of the soil around the base of poles should be made to see that it is intact and, where poles are set in embankments, to be sure that the supporting earth is not washed away. Where poles are set in soft marshy soil, or where installed in otherwise unstable ground areas, such as sludge pits sometimes found in oil refineries, these poles will have to be carefully inspected for settlement and shifting and for the possibility of their leaning if undue strain occurs at the top of the pole. In this case, of course, necessary guying to straighten the pole will be required. The correction of settlement or shifting of poles in such areas is quite difficult and may require driving a pile into the ground to good soil and lashing the pole to it.

2310.04 (a)—Vehicle Damage. Where poles are located close to roadways, inspect for damage coused by passing vehicles. If any are in a bad or weakened condition they should be replaced and the new pole protected by means of a fence or protective guard.

2310.04 (b)—Dry or Butt Rot. Inspect all poles and cross arms periodically for deterioration which might be in the form of dry rot, butt rot, checks, etc. Often a pole may appear in satisfactory condition, but will be seriously dry rotted. This can be determined by means of a pocket knife or a similar sharp instrument prodded against the outside shell of the pole. If it penetrates easily to the inside at this point and at other test points on the pole, further investigation should be made by cutting into the pole through a larger opening. If this reveals that the inside wood has dry rotted, the pole should be replaced. The usual evidence of dry rotting may occur in places throughout the length of the pole, but can usually be determined at or near the base.

Butt rot generally occurs at the ground line of the pole and in the area buried in the ground. This check can be made by excavating alongside the pole to determine if any rotting has taken place. A general inspection of the pole should be made to see that it has not become warped, that it is not leaning and that it is in general satisfactory for supporting the lines and suitable for linemen to climb. Depending upon its condition, replacement or guying may be necessary.

2310.04 (c)—Cross Arm Rot. Cross arms likewise should be inspected periodically to be sure that they have not rotted. Inspection should be carefully made where the cross arm is bolted to the pole and where braces are attached. Any cross arms showing evidence of being unequally loaded, causing the arm to lean from the horizontal, should be corrected by adequate bracing, or by a better balancing of the load. The condition of the hardware should be inspected for corrosion, and cleansed and painted as necessary. Bolts or other hardware corroded to a point deemed unsafe, should be replaced.

2310.04 (d)—Steel Poles and Cross Arms. Steel poles or towers and cross arms should be inspected for crumbling of the concrete footings, settling and washouts or erosion of the soil around these footings. Any found to be in poor

condition should be corrected as necessary. In the case of washouts, necessary steps should be taken to prevent this condition. Inspect thoroughly for corrosion and, if considered unsafe, replace as necessary, otherwise clean and paint.

2310.05—Line Insulation. Line conductors are either bare, insulated with a weather-proof covering, or in cable form, lead covered, supported by means of a messenger cable. The first two forms of conductors depend on the supporting insulators for their insulation, whereas the cable form depends on the conductor insulation and the lead covering which is a protection for the insulation. The three-braid, weatherproof insulation is used as a weather protection only of the conductor, and should not be depended upon as insulation against a person's touch. In the event that this covering deteriorates and starts to fray or come loose in large strips, the conductors should be replaced, or the weatherproof braids stripped off, if not required for protection against weather or corrosion. Pieces of braid hanging from such conductors are apt to touch any live conductor that may be present below and, when wet, introduce the possibility of failure between conductors.

2310.06—Line Supporting Insulators. Line supporting insulators should be inspected to see that the pins are tight and that wooden pins have not rotted. Replace as necessary. Where metal post insulators are used, inspect the bolts for corrosion. Inspect insulators for breakage and replace any that are damaged or chipped. Inspect to see that the conductors are adequately fastened and supported on the insulators. Any dirty insulators should be cleaned at this time.

2310.07—Conductors. The usual practice for pole line work is to use hard-drawn cable, copper covered steel, or aluminum steel reinforced wire. If soft-drawn copper wire is used, the tendency to sag is materially increased and it becomes necessary to inspect more often to ensure that the sag is not too great. Repeated loadings, due to ice and wind, will cause any of the above mentioned conductors to sag after a period of time. Therefore, it is necessary to make periodic inspections to determine that the sag is maintained at the proper amount in order not to interfere or reduce the clearance to an unsafe point between conductors on different cross arm levels.

Figures giving the proper amount or the recommended tension of the conductor for various pole spans can be obtained from various recognized sources, including the "Standard Handbook for Electrical Engineers" and the "National Electrical Safety Code". The proper amount will be determined also by the section of country in which it is installed, for the ice and wind loadings are so figured.

2310.07 (a) — Replacement of Conductors. In the event any replacements are necessary, the inspector should be notified so that he can caution against providing too little climbing and lateral working space and to see that ample clearance has been allowed between cross arm levels.

2310.08 — Equipment on Poles and Cross Arms.

2310.08(a)—Potheads. Potheads should be inspected periodically to see that there has been no compound leakage; that the insulators are in good condition; that none are broken or damaged; that the terminal connections are tight and that there has been no corrosion of any bolts and nuts used. On disconnecting type potheads, also inspect for corrosion at the contacting points and see that the contacts are making a good connection. Inspect for any damaged or frayed wiring into the disconnecting parts. Potheads should be rigidly bolted to the pole or cross arms.

2310.08 (b) — Transformers. Transformers should be inspected for oil leakage and rusting of the transformer tank or other parts. Also examine the ground connection to see that it is effective. The oil should be checked to see that it is in good condition and maintained at the proper level. For a complete inspection of transformers see "Power Plant and Substations" in this manual.

2310.08 (c) — Fuses and Switches. Fuses and switches should be inspected for corrosion and poor contact-making surfaces. Any found to be badly corroded should be throughly cleaned and it is recommended that, if the corrosion is persistent, the contact-making parts be silverplated. The ease of operation of the fuses or switches should be checked to be sure that they can be operated. Also check insulators for damage.

2310.08 (d) — Lightning Arrestors. Lightning arrestors cannot very well be checked in the field to see if they are effective, but they should be inspected periodically to be sure that none are broken and that the lead-in connection is intact. On certain types, the ground wire connection has a drop-out feature, indicating that the arrestor has operated and these should be replaced as necessary. On other types, with bolted or soldered ground connections, these should be inspected to be sure that the ground wires are tight and effective.

2310.09 — Pole Line Grounding. Any ground conductors carried down the pole for the purpose of grounding equipment, circuits, or for lightning arrestors should be inspected to see that they are intact throughout the run down the pole. Such ground conductors should be protected by means of wooden molding and this should be inspected to see that it has not been damaged because it acts as an insulating safety precaution for linemen working on the pole line. For further discussion of grounding and effectiveness of grounds see under "Grounding, Stray Current, and Static Electricity" in this manual.

2310.10 — Guying. Inspection should be made periodically of steel guys to determine that excessive corrosion, fraying or other damage has not occurred and that there has been no slippage or cutting of the guys into the poles. Strain insulators should be checked to see that none are broken. Any guys found to be in poor condition should be replaced.

2310.10 (a) — Anchors. The condition of any anchors used should also be checked to see that there is no tendency for them to pull out of the ground, also for corrosion. Any anchors weakened and deemed unsafe should be replaced.

2310.10 (b) — New Guys. Any poles that are found leaning from excessive strain should have adequate guys installed after straightening.

2311. Underground Power Systems

2311.01 — General. It is not the intent to cover here the necessary safety precautions to be taken by linemen or electricians performing work on underground systems. Complete detail requirements as generally recognized are given in the "National Electrical Safety Code", which should be strictly followed. The men assigned to this work should be equipped with all the latest safety devices to protect against live wires as well as the usual equipment, such as safety belts, rubber gloves, etc.

2311.02 — Preparation of Equipment for Inspection. Whenever possible it is recommended that circuits be worked dead. It is also advised that at least two men be assigned to the work; the second man being above ground to act as helper and to observe the lineman continuously and caution him when necessary against coming in contact with live wires. The man on the ground, in addition, should watch to see that the cable splicer has adequate ventilation, and that he is not being overcome by fumes or gases which might penetrate the manhole.

2311.03 — Marking Protecting Equipment. See Section 2310.03

2311.04 — Ducts and Manholes. The usual types of underground construction for electric ducts make use of either fibre or asbestos-cement ducts buried directly in the ground, or encased in concrete; or, tile ducts laid directly in the ground. In general, encasing in concrete has been found to be better for refinery use, because of the protection it offers against any excavation work. In some organizations this concrete has been dyed a distinctive color to make it more readily recognizable.

2311.04 (a) Contour Changes. Periodical inspection should be made to check for any settling of ground in the area

the ducts pass through, because such settlement is apt to result in their damage. Also, any washouts in this vicinity or around the ducts should be corrected to prevent damage.

2311.04 (b)—Construction Work. The inspector should keep in close contact with excavation or construction work, thus avoiding any possibility of damage due to breaking into the ducts, or from heavy equipment being moved over them. This also applies to manholes. To coordinate the excavation work, it is recommended that the engineering department note carefully on any construction drawings those points at which the electric duct lines are crossed to prevent, insofar as possible, workmen from causing damage.

2311.04 (c) — Warning Signs. In certain cases, in areas where the inspector deems it advisable, he should insist on special markers being installed over the run of duct as a warning.

2311.04 (d)—Manholes. Manholes are usually of reinforced concrete or brick construction. They should be inspected periodically for settlement cracks in walls, floor and roof, or for damage to the roof that may have been caused by trucks or the moving of heavy equipment across them. The manhole cover and frame should also be inspected to see that they are not damaged or broken. Electric manholes should be marked "Electric", preferably cast into the cover. This avoids the possibility of anyone mistaking the manhole as being used for sewage purposes, where workmen will often dispose of old oil, etc. Also inspect for water, oil and gas conditions, and keep them cleared of any debris.

The question of keeping the manholes clear of water and oil is open to considerable discussion. In certain cases it is felt that it is better to keep them continuously pumped out, but it is then questionable, if the manhole system should become filled with gas, if it would result in a greater hazard. If the manhole and duct system are kept filled with water, any resulting fire would be confined to a single manhole. Therefore, it appears that individual judgment will have to be used to weigh all factors involved, particularly the question of gas, in arriving at a satisfactory solution to this problem.

2311.05—Cables. The types of cables generally used for underground work are of the lead covered type and non-lead covered type. Any inspection of the cable will naturally have to be confined to that which can be observed in the manholes.

2311.05 (a)—Lead Covered. A periodic check of the lead covered type should be made to determine any chafing of the covering at the duct mouth, resulting from expansion and contraction of the cables. Where such chafing is

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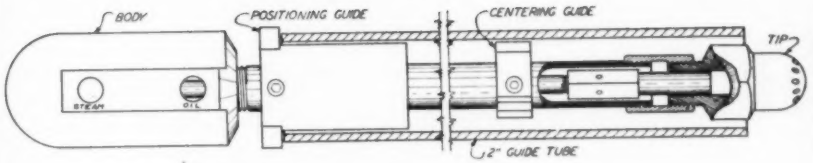

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found, a suitable protective means should be installed around the cables at this point; either a lead shoe or conventional protectors. Inspect to see that the cables are well supported on the cable racks; that none of the cable racks have corroded to a point where unsafe; or that the bolts have not corroded, allowing the rack to pull away from the manhole wall. Inspect the balance of lead covering through the manhole to see that no mechanical damage or corrosion or electrolytic action has taken place. Also inspect splices and replace any found leaking or collapsed.

2311.05 (b) — Bonding. Inspect bonding connections of the cables to see that they are intact and effective and that the ground wire and its connections are in good condition. Inspect any fireproofing used to see that it has not been damaged or broken away from the cable.

2311.05 (c) — Non-Lead Covered. On non-lead covered types of cables, the inspection will be very similar to that of the lead covered types, except those items pertaining to the lead covering itself. Inspect for any damage to the covering or insulation and to see that oil, if present, has not caused any deterioration. It is recommended that such inspections of non-lead covered cables be carried out when they are de-energized.

2312. Grounding, Stray Currents and Static Electricity

2312.01 — General. The inspection to determine the effectiveness of grounding and means to take care of stray currents and static is very important in all phases of oil refining work. The nature of products handled and the fact they are moving continuously through pipes, vessels, tanks, etc. require careful planning and rigid inspection routines. The fact that protective means used to combat these conditions serve no purpose in the transmitting of useful electric energy or power, will often lead to their neglect.

2312.02 — Grounding and Stray Currents. Inspection of earth connections should be made periodically, preferably at intervals not longer than a year, to determine their effectiveness. Several makes of instruments are now available for making these measurements easily and quickly. Such measurements should show not more than 12 ohms resistance and preferably less. The season of year will influence greatly the readings. In hot dry weather, they will be higher than in the spring of the year, for the soil is then wet to a much greater depth. This should be taken into consideration and readings staggered to include both seasons. Suitable records should be maintained to show changes.

2312.02 (a) — Location Diagrams of Ground Conductors. Suitable records should be kept of the routing of ground conductors where located underground and when any excavations are made the inspector should be notified so that he can caution and inspect against any damage.

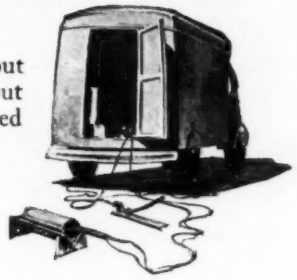
2312.02 (b) — Grounding Connections. All bolted or soldered connections should be inspected periodically for tightness, and to see that no corrosion or damage has occurred. Where the conductor is exposed and liable to damage, it should be checked. This is particularly true on equipment grounds for motors, transformers, etc. Often, these come through the floor, and it is at the floor line that damage may occur. Where the ground conductor is bolted to the frame of equipment or steel work the joint should be inspected for tightness and corrosion. The surfaces should be clean and tinned. Where not advisable to depend on bolted joints because of poor contact, brazing makes a good job.

2312.03 — Bonding. Certain equipment and other metal parts are also bonded together in addition to their being grounded. The inspection of the bonding in these cases is as important as the grounding and the above inspections for effectiveness of joints in the grounding system should be followed.

2312.03 (a) — Stray Currents and Cathodic Protection. Stray currents and the bonding and use of cathodic protection means are necessary to overcome the deteriorating effects of such currents on underground pipe lines, or interconnected steel work that is in contact with the earth, also lead covered underground cables. The bonding of cables has been discussed under Par. 2311.05 (b). If the bonding used is not effective, or insufficient, there is also the possibility that the stray currents, if of sufficient mag-

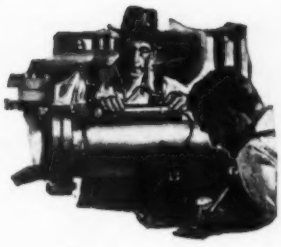
PENETRON I —

Measured thickness without drilling and calipering but weighed 400 lbs — required a trailer to carry it.

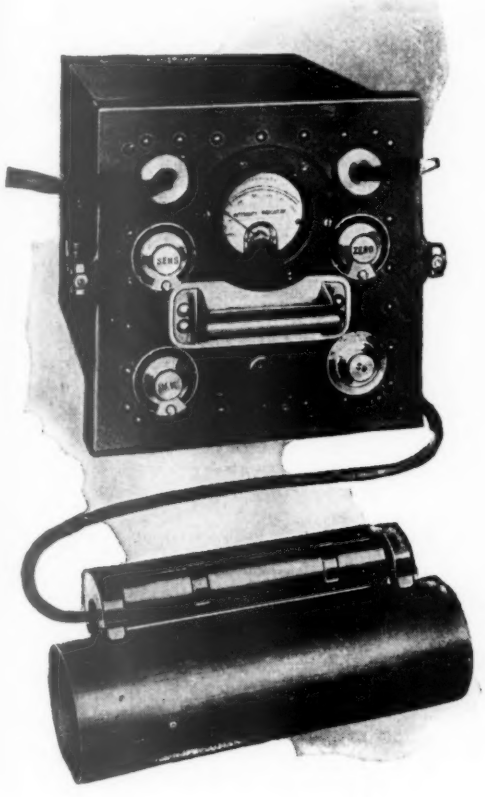


PENETRON II —

Achieved portability without loss of accuracy. Weight, only 40 lbs.



Research in Action!



PENETRON III —

Thanks to continuing research today's Penetron is *easily* portable yet even more sensitive. It weighs only 25 lbs.

How continuing Texaco Research developed a radically new idea and then made it better and better

THE PROBLEM: The drilling and calipering of oil industry equipment to check corrosion is costly, time consuming and often unsatisfactory. Texaco Research sought a better method that would quickly and accurately measure the thickness of a pipe or vessel *working from one side only.*

FIRST SOLUTION: After careful consideration exhaustive experiments with radium were undertaken. This resulted in the original Penetron, an efficient instrument but so heavy it had to be carried in a trailer.

SECOND SOLUTION: Further research reduced the weight from 400 to 40 lbs. The instrument was now portable and equally efficient but still heavy.

PRESENT SOLUTION: An instrument of even greater accuracy weighing only 25 lbs.

Thanks to Texaco Research today's Penetron is easily portable, easier to use. In addition to measuring wall thickness it is used to determine both the density and levels of contained liquids from outside the equipment.

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TEXACO DEVELOPMENT CORPORATION

A Subsidiary of The Texas Company

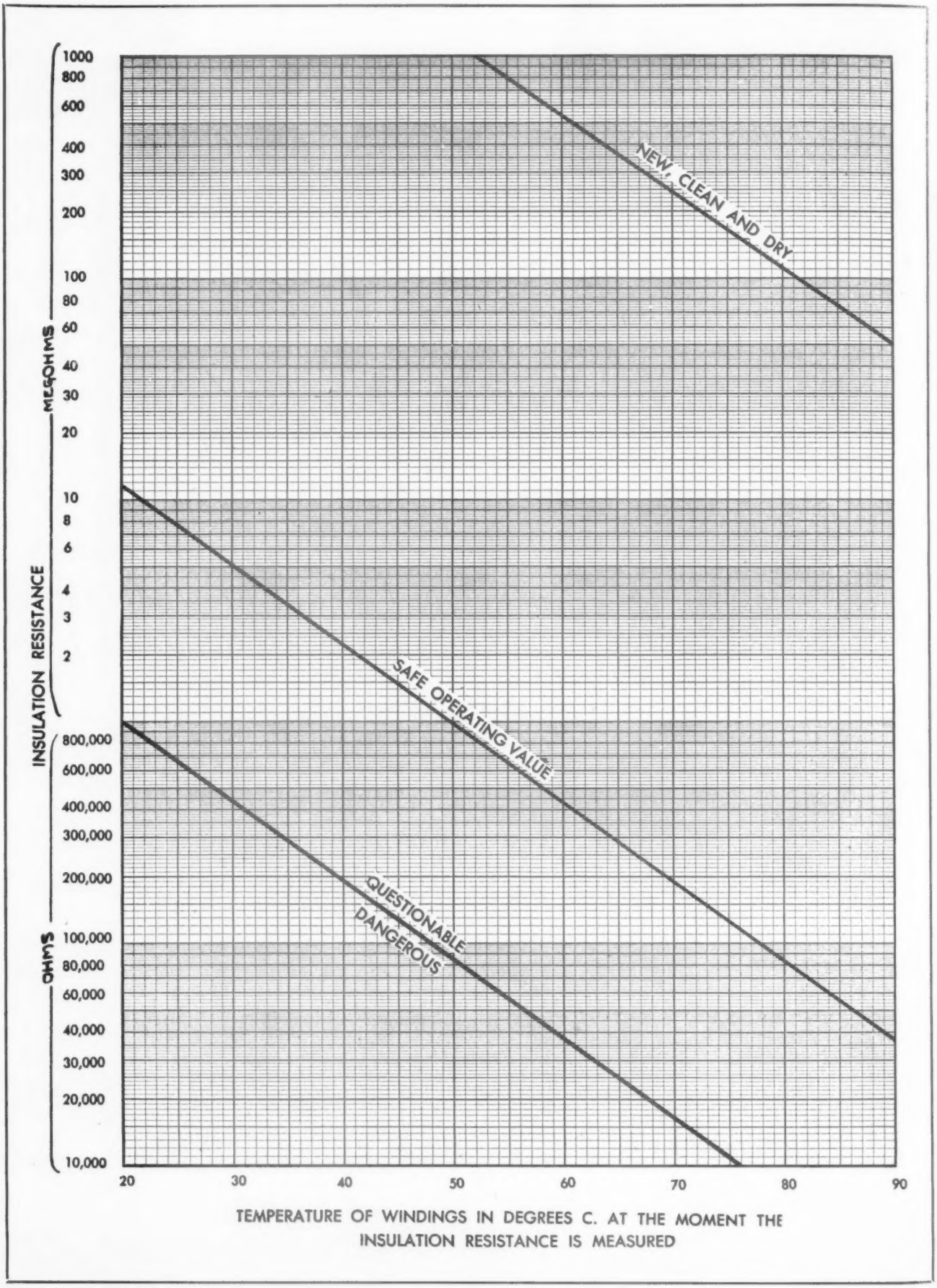

Fig. 1—Effect of temperature on the insulation resistance of induction motors

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pioneers again!

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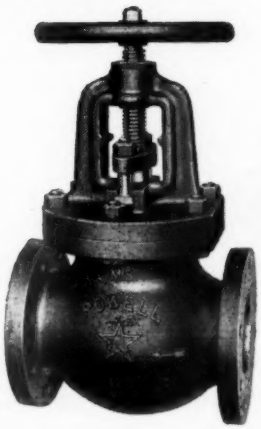
Ampco Alloys are especially valuable to the chemical and refining industries, not only for their corrosion resistant qualities, but because of their resistance to abrasion and their ability to withstand much higher temperatures than standard bronzes and brasses which have top temperature limits of about 500 F to 550 F. Also available are Powell Iron Body and Steel Valves in which the trim, or working parts, such as stems, seats, wedges and discs are made of Ampco Alloys.

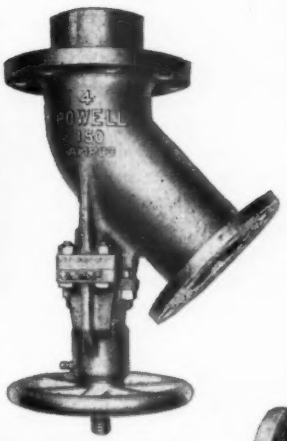
Powell Engineers will be glad to advise you on applications of Ampco Alloy Valves. Special bulletin on request.

The Wm. Powell Co., Cincinnati 22, Ohio

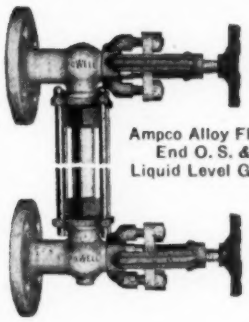
125-pound Iron Body Gate Valve with Ampco Alloy Trim.



125-pound Iron Body Globe Valve with Ampco Alloy Trim.

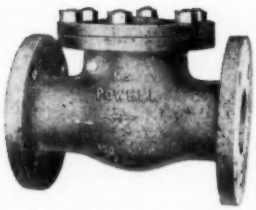


Ampco Alloy Flush Bottom Tank Valve.

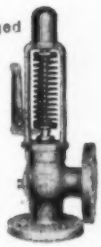


Ampco Alloy Flanged End O. S. & Y. Liquid Level Gauge.

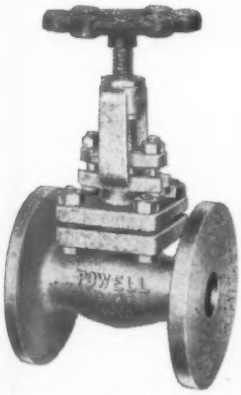
200-pound Ampco Alloy Screwed End Gate Valve.



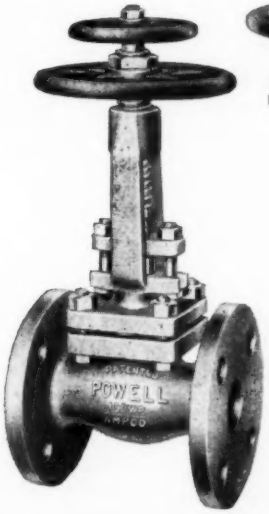
150-pound Ampco Alloy Swing Check Valve.



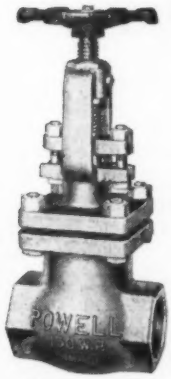
Ampco Alloy Flanged End Angle Relief Valve.



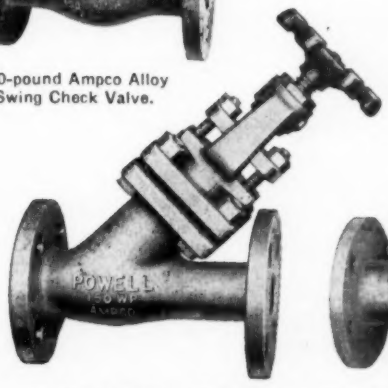
150-pound Ampco Alloy Flanged End O. S. & Y. Globe Valve.



150-pound Ampco Alloy O. S. & Y. Globe Valve, equipped with Powell Patented Seat Wiper.



150-pound Ampco Alloy Screwed End O. S. & Y. Gate Valve.



150-pound Ampco Alloy Flanged End O. S. & Y. "Y" Valve.

Ampco Alloy Flanged End Ground Key Plug Cock.

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nitude, can cause arcing or sparking between certain points. This would be likely to occur when portable or flexible devices are used. Metallic cables stretched between two points of pipe lines, or steel structures not bonded might create such a condition.

2312.03 (b) — Protection of Loading Racks. Periodic inspection of bonding of pipe lines is necessary. Bonding used around valves or other similar fittings to carry stray currents must be intact. Rail joint bonding must be inspected and any found frayed or damaged should be replaced because such trackage leads to loading racks, with the possibility of causing trouble there. All loading and unloading rack piping, structure and track should be bonded together and grounded. It is further recommended that the track be insulated from the main line track. In certain cases, insulating joints may be installed in pipe lines for the purpose of breaking the path of stray currents so they can be taken care of by other means or paths.

2312.03 (c) — Measurement of Stray Currents. Measurements with suitable electrical instruments should be made periodically to determine the amount and direction of these currents. It is advisable to inspect piping periodically at those points where the current leaves the piping to determine the extent of damage that may have been caused.

2312.04 — Static Electricity. The inspection of conductors and contact surfaces or connections follows the same procedure as that for grounding conductors. Inspection should be made periodically to see that there has been no damage or corrosion and that all joints and connections are clean and have good metallic connection. In certain instances where the conductor must be flexible a very rigid routine is necessary. The frequency of inspection, however, depends upon the extent of use. Ships, barges, tank car and trucks and their loading racks, and in some cases floating roof tanks are examples. Such flexible conductors and their attachments require careful inspection for broken or frayed wires in the conductor, and to see that the attachment devices make good contact under sufficient contact pressure. Filling hoses, because of the heavy service they receive, are particularaly important in this inspection.

2312.04 (a) — Agitator Protection. Agitators sometimes make use of an antenna system of wires to dissipate any electrostatic charges occurring from agitation of the liquid, and such systems require inspection periodically to see that they are intact, and all connections are good.

Section 4—Operating Limits

241. Determination of Limits.

241.01—General. It is rather difficult to outline very definite recommendations for the determination of limits in the operation of electrical equipment from the standpoint of safety. In numerous instances the question of obsolescence or safety is left up to the judgment of the inspector.

241.02—Circuit Breakers. Oil circuit breakers purchased and installed years ago may be limited in interrupting capacity requirements due to the design of the breakers at the particular time, or the installation of additional generating capacity to the plant system or at locations where power is purchased from an outside source.

241.02(a) — Modernizing Protective Equipment. The best method of correcting this condition is a question of economics and the importance of the equipment. It is possible to install a main feeder breaker of sufficient capacity, with tripping mechanism adjusted to provide short circuit protection for all starters. The objection to such an arrangement is that all starters will trip in the event of a short, and on important drives this may be objectionable. It is also possible to provide additional branch circuit protection for a group of motors, or provide all starters with proper interrupting capacity. The latter arrangement would be more expensive, but the question of cost depends on the service expected of the equipment.

241.03—Inspecting Equipment in Intermittent Service. Electrical equipment in intermittent service, or allowed to remain idle for a considerable length of time between operations, has a tendency to absorb moisture. In testing insulation resistance of such equipment, there is always a question as to the minimum insulation resistance in megohms with which it would be safe to operate equipment without possibility of failure. Electrical manufacturers will not commit themselves in this point, but from an analysis of Fig. 1, "Effect of Temperature on the Insulation Resistance of Induction Motors", it appears that it would be safe to operate equipment having an insulation resistance as low as two megohms. It will be noted from the curve that the insulation resistance varies considerably with temperature. Fig. 1 appears on page R-906.

241.04 — Correcting Low Insulation Resistance. When the insulation resistance is lower than two megohms, it would be advisable to clean and dry by methods previously outlined. Motors in damp locations in intermittent service can be protected against moisture by means of covering the motor and using space heaters.

241.05 — Dielectric Strength of Transformer Oil. Transformer oil should be tested periodically for dielectric strength and the presence of sludge oil. When new it should have a dielectric strength of 22 KV. If the dielectric strength is less than 15 KV, the oil should be filtered or replaced.

Patent Trends in Petroleum Refining

By Peter J. Gaylor

Patent Attorney and Editor of "Technical Survey", Newark, N. J.

Non-Foaming Antifreeze Solutions

In the use of glycol type compounds as antifreezes, hydrogen ion concentration has been the determining factor as to corrosion of the metal surfaces. Various alkaline materials have been added, together with buffer salts, but excessive foaming has been encountered with such additives.

Mixture of ethylene and propylene glycols (sp. gr. 1.0075)	97.5%
Water	2.5%
To which are added:	g./gal.
Sodium Nitrite	4
Sodium Carbonate	12
Disodium Phosphate	4
Linseed Meal	5
Calcozine Red BX Dye	0.08

The freezing characteristics of aqueous solutions of this antifreeze have been disclosed in U.S. 2,382,698 to be as follows:

15 % solution	20°F.
27.5% solution	10°F.
35 % solution	0°F.

In order to improve this mixture as to foaming and corrosion properties, 0.2 wt.-% of various alkyl phthalates were added. The foaming data reported will be found in Table 1.

The exceptional foam-suppressing properties of sec.-butyl phthalate are particularly noteworthy. The solutions containing 0.2% phthalate had pH values of about 10.5.

TABLE 1—Effect of 0.2 wt.-% of Alkyl Phthalates on Foaming Characteristics of Antifreeze Solutions

	No Phthalate	Phthlate n-Butyl	Phthlate Sec. Butyl	Phthlate n-Octyl
Initial foam (ht foam/ht liquid)	20%	14%	3%	14%
Type of foam	coarse	medium	medium	fine
Time to expose liquid surface	30 min.	10 sec.	5 sec.	50 sec.

Rust Preventives

Slushing oils are generally non-drying compositions employed for arresting, inhibiting and preventing metal corrosion. In the past, various mixtures of oils and soaps were used, but war expansion and usage under extreme conditions showed such compositions to be unsuitable in satisfactorily displacing water from metal surfaces.

One formula employed by S.O.D. consisted of 85% petroleum oil of 750 sec. Say. at 100°F., 10% of a 50% oil solution of sodium (mahogany) sulfonates obtained by treating white oil stocks with strong acid, and 5% degras. In its U. S. 2,382,-699, the company reports that it has been able to improve the properties of the composition considerably with respect to water displacement by the addition of certain amine soaps, particularly morpholine, diethylethanolamine or dicyclohexylamine naphthenate. About 2% of the amine soap is employed.

Corrosion

With various hydrocarbon reactions employing aluminum halide-hydrocarbon complexes with free HCl, e.g. isomerization, alkylation, etc., there is encountered considerable corrosion of steel, iron and other ferrous containing metals as well as nickel. Shell has found that the addition of sodium or calcium chloride as inhibitor reduces the corrosion considerably.

In one series of tests on polished low carbon steel and nickel contacted for 24 hrs. in $AlCl_3$-hydrocarbon complex at 100°C., the following corrosion rates were reported. in mils penetration per year:

Inhibitor Wt.-% of Complex	Corrosion Rate Low C Steel	Ni
None	5200	800
6% NaCl	220	—
9% NaCl	150	160
12% NaCl	16	4
12% $CaCl_2$	5	2

and the conversion of methylcyclopentane to cyclohexane was 40%. The ratio of naphthenes to paraffins in the extract was 1.62 compared to 1.25 in the charge, showing a selectivity on the part of the complex.

U. S. 2,382,446 covers a similar process in reverse, there being an equilibrium between the two reactions. A 40% conversion of cyclohexane to methylcyclopentane was obtained.

Isomerization of Naphthenes to Hydroaromatics

In some instances it is desirable to convert naphthenes such as methyl and polymethyl cyclopentanes into hydroaromatics such as cyclohexane and its methylated derivatives. In its U.S. 2,382,445, Shell discloses a process for doing this, using a halide catalyst.

In one example, a methylcyclopentane concentrate analyzing 4.5% methylpentane, 40% *n*-hexane, and 55% methylcyclopentane was contacted in a single stage operation with an $AlCl_3$-hydrocarbon complex, using 2:1 complex to hydrocarbon, 30 min. contact time and 70°C. HCl was bubbled through the liquid to maintain an HCl concentration of 0.1% of the hydrocarbons charged.

The raffinate phase contained 70 vol.-% of the hydrocarbons treated.

Lube Oil Additives

Among the more modern additives in the lubricating oil field are the metal non-gelling soaps. Usually the metals are calcium or barium, although tin and aluminum have also been employed in heavy duty (Diesel) oils. Most of them have stayed clear of the heavier metals. Also, most of them require additional antioxidants and bearing corrosion inhibitors.

In its U.S. 2,382,781, duPont describes the use of ferric dithiocarbamates having the formula

$[R_1—(R_2N)—(C=S)—S—]_3Fe$

as lubricant stabilizers having detergent, stabilizing and corrosion inhibiting properties. Some of the test results reported are given in Table 2.

As is apparent from the table, both Co and Ni salts are less effective than Fe in improving the oil condition, and, furthermore, they increase bearing corrosion. About 200-500 ppm of ferric diamyl dithiocarbamate is preferred.

Synthetic Lubricants

Carbide's recent announcement of a synthetic non-petroleum lubricant [1] has started speculation on whether petroleum oils will be gradually displaced from the

TABLE 2—Detergent, Stabilizing and Corrosion Inhibiting Properties of Ferric Dithiocarbonates as Lubricant Additives

Oil	Additive	P.P.M. iron in oil	Hours tested	Oil condition rating	Engine cleanliness rating	Cu-Pb corrosion
A	None (avg. 4 runs)	0	66⅔	Bad	55.0	1.05
A	Ferric dibutyl dithiocarbamate	200	66⅔	Good	91.0	0.57
A	Ferric diamyl dithiocarbamate	500	66⅔	Good	93.0	0.10
A	Cobalt dibutyl dithiocarbamate	200	66⅔	Poor	96.5	2.73
A	Nickel dibutyl dithiocarbamate	200	66⅔	Poor	72.5	1.16
B	None	0	33⅓	Bad	63.0	1.20
B	Ferric diamyl dithiocarbamate	500	66⅔	Excel.	91.0	0.10
B	Cobalt dibutyl dithiocarbamate	200	66⅔	Poor	73.0	1.44

TABLE 3—Viscosity Characteristics of Synthetic Lubricants
(Viscosity, centistokes, at °F.)

Compound	—40	0	100	200
Methyl Benzoate	Viscous	6.1	1.39	0.73
Ethyl Benzoate	20.4	6.5	1.52	0.79
Propyl Benzoate	47.5	11.3	2.09	0.91
Butyl Benzoate	72.8	14.1	2.27	1.03
Isoamyl Benzoate	79.1	17.7	2.56	1.11
Benzyl Benzoate	Viscous	93.8	5.06	1.73
Butyl acetyl ricinoleate	Viscous	423.	17.9	5.
Ethyl Lactate	69.5	12.9	1.72	0.75
Butyl Lactate	135.	22.3	2.44	0.93
Isobutyl Lactate	231.	29.1	2.49	0.93
Diethyl Oxalate	14.2	5.3	1.37	0.72
Dibutyl Oxalate	22.0	11.4	2.25	1.05
Monobutyl Ether of Diethylene Glycol	173.	33.7	4.1	1.36
Monomethyl Ether of Diethylene Glycol	132.	25.9	3.17	1.21

TABLE 4—Properties of Synthetic Lubricants

	Boiling Pt. °F.	Flash Pt. °F.	Freezing Pt. °F.
Monomethyl ether of diethylene glycol	380	200	—75
Monoethyl ether of diethylene glycol	396	210	—103
Monobutyl ether of diethylene glycol	448	230	—60
Diethyl ether of diethylene glycol	367	180	—
Ethyl lactate	311	129	—
Butyl lactate	370	160	—45
Isobutyl lactate	350–90	—	—

lubricating field in favor of non-petroleum products tailor-fitted to the intended use. Carbide's product is believed to be produced from a "trick glycerine" [2], and although much information on it is yet unavailable, it is known that the product has a low congealation point, thus making it a highly suitable lubricant for refrigerating machines [3]. However, the company has already begun an advertising campaign on its "Prestone Motor Oil" at 75c a quart, which is made in only one grade for both summer and winter. It is claimed that the oil gives instant motor turnover even at sub-zero temperatures, cleans the engines as you drive, and does not deteriorate like petroleum oils.

The idea of using non-petroleum lubricants for special uses is not particularly new. A number of esters have been proposed for this use [4], and in fact, S.O. N.J. has been supplying its Univis P-38 having the low pour point of −90°F. to the Armed Forces for gyroscope and bombsight lubrication [5]. However, this oil sells for $11/gal., so that it cannot be expected to find extensive application unless its price comes down appreciably. Phosphate esters, such as tricresyl phosphate have been proposed as lubricants for turbines [6] and instruments [7] because of their high spontaneous ignition temperatures and non-creeping properties.

Some recent patents in this field show further activity. For example, the Cities Service patents 2,383,147 and 916-7 disclose the use of alkyl lactates for low temperature lubrication, in the range of −50° to 200°F. For example, butyl lactate boils at 370°F., melts at −45°F. and flashes at 160°F. By adding an E.P. agent such as "Polane", (e.g. ethyl laurate or chlormethyl stearate) or tricresyl phosphite, the lubricant is able to carry over 1000 lbs. in the 4-ball testing machine. Addition of 6% sodium stearate produces a grease.

Alkyl oxalates, alkyl acetyl ricinoleates and Carbitols and other compounds also have been proposed for lubricating uses in these patents. The viscosity characteristics of these synthetic lubricants may be obtained from Table 3. Boiling, freezing and flash points are given in Table 4. It appears that the monoethyl and butyl ethers of diethylene glycol show superiorities in V.I. and other properties over other listed compounds.

Other synthetic lubricants which have found special uses recently are the Dow-Corning (polysilicone) fluids [8], the production of which has been discussed previously in this section. These compounds may be polymerized to light or heavy fluids or greases, and their uses so far have been mainly for stopcock and valve lubrication.

Interference Declared

On Page R-504 of the July 4, 1945 Technical Section of National Petroleum News reference was made to U. S. patent No. 2,375,007, assigned to Shell Development Co. and relating to anti-foaming compositions containing silicon-type anti-foam agents.

National Petroleum News has been informed that the United States Patent Office has recently declared an interference between this patent and a patent application of C. E. Trautman and Henry A. Ambrose, assigned to Gulf Research & Development Co. It is understood that Trautman and Ambrose have been made senior parties in the interference, by virtue of a filing date earlier than the filing date of the application on which the Shell Patent was issued.

Selected Patents of the Month

U.S. 2,384,796 (S.O. Ind.)—Adding methanol during alkylation.
U.S. 2,384,858 (Sun)—Temperature control.
U.S. 2,384,866 (Wiczer)—Extracting unsaturates from cracked gasoline, converting them to ethers, esters and ketones, and blending with raffinate.
U.S. 2,384,902 (S.O.D.)—Separating acetylenes from other hydrocarbons.
U.S. 2,384,916 (Jasco)—High molecular weight isoolefin polymers.
U.S. 2,384,926 (S.O.D.)—Sulfur from H_2S.
U.S. 2,384,932 (Socony)—Hydrocarbon conversion.
U.S. 2,384,935 (S.O.D)—Ketone condensation product.
U.S. 2,384,942-6 & 5 217 (Socony)—Synthetic gel pellets for hydrocarbon reactions (TCC beads?).
U.S. 2,384,960 (S.O.D.)—Metal cutting lubricant comprising amine mixture in isopropanol.
U.S. 2,384,967 (S.O.D.)—Separating catalyst from oil.
U.S. 2,384,975 (S.O.D.)—Isoolefin-nonconjugated diolefin copolymer.
U.S. 2,384,984 (Weizmann)—Styrene and ethyl benzene from low molecular weight olefins.
U.S. 2 385 006 (Westinghouse)—Gas turbine.
U.S. 2,385,037 (I.C.I.)—Nitroethylene derivatives.
U.S. 2 385.074 (A.P.C.)—Continuous fractional distillation.
U.S. 2,385,111 (I.C.I.)—Nitroethylene.
U.S. 2 385 133 (S.O.D.)—Alkylation.
U.S. 2,385.158 (S.O.D.)—Sulfide corrosion inhibitor in fuels.
U.S. 2,385,166 (S.O.D.)—Diolefins and vinyl benzenes.
U.S. 2.385,172 (Jasco)—Coagulating emulsion polymers.
U.S. 2.385,175 (Shell)—Inhibiting pipe line corrosion with desulfurizing material.
U.S. 2.385.187 (S.O.D.)—Ethyl benzene.
U.S. 2 385.189 (Lummus)—Catalytic reactor.
U.S. 2,385,190 (Goodrich)—Diene polymerization.
U.S. 2.385.200 (Hooker Electrochem.)—Reacting gases with liquids.
U.S. 2 385 216 (S.O.D.)—Catalytic cracking.
U.S. 2 385 235 (Lummus)—Styrene distillation.
U.S. 2,385.236 (Schutte)—Emulsion deoiling.
U.S. 2.385.237 (S.O.D.)—Codimer.
U.S. 2 385.300 (U.O.P.)—Alkyl cyclopentanes.
U.S. 2.385.301 (Socony)—Sulfurized condensation product.
U.S. 2.385,303 (U.O.P)—Alkylated aromatics.
Austral. S. P. 120,171 (I.C.I.)—Benzene hexachloride insecticide.
Austral. S. P. 120,122 (I.C.I.)—Polymers of dihydropyran.
Can. 430 059 (S.O.D.)—Detergent.
U.S. 2 385.325-6 (Shell)—Catalytic cracking.
U.S. 2,385,327 (Amer. Cyan.) — Acrylonitrile from acetylene and HCN.
U.S. 2,385,344 (S.O. Ohio)—Converting propane to isobutane in presence of BF_3-HF.
U.S. 2,385,361-3 (Safety-Fuel Inc.) Solidified normally liquid hydrocarbons.
U. S. 2,385,437 (Philip Carey Mfg.)—Bituminous paint.
U.S. 2,385,444 (Socony—Sec.-neohexane chlorides.
U.S. 2,385,446 (Kellogg)—Catalytic cracking.
U.S. 2,385,469-70 (Amer. Cyan.)—Acrylonitrile from acetylene and HCN.
U. S. 2.385.475 (Hooker Electrochem.)—Granular hexachlorethane.

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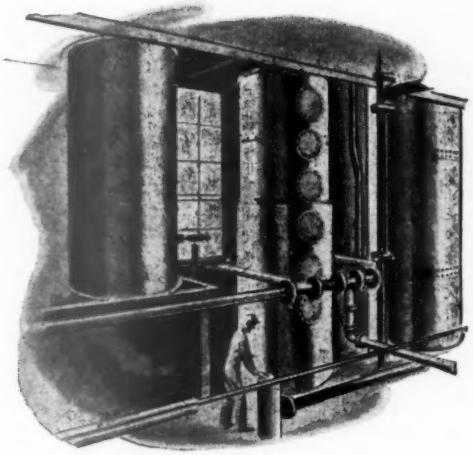

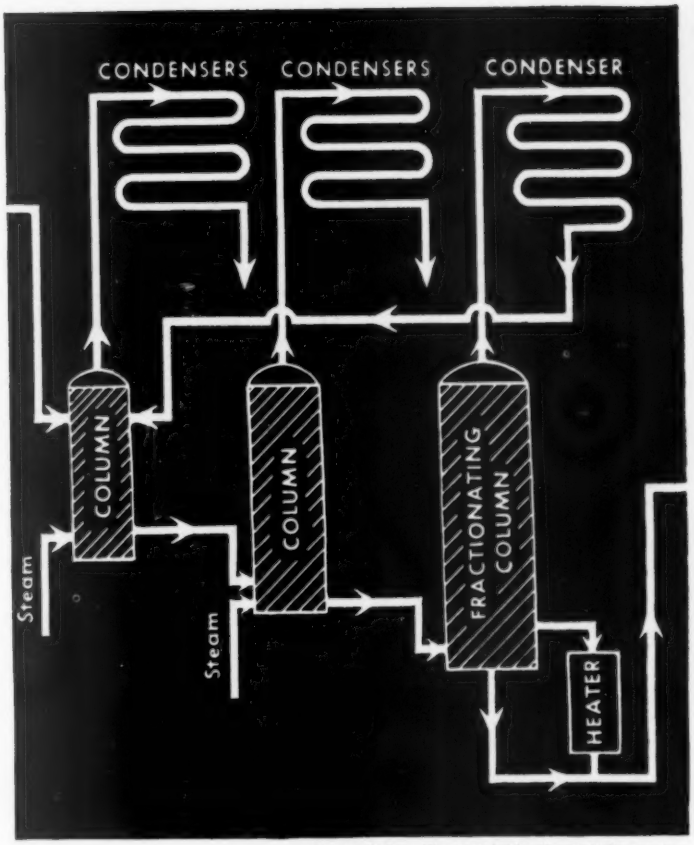

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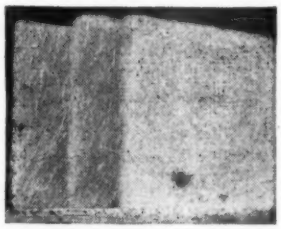

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Vapor Phase Oxidizing Cracking of Oil Products

By L. I. Berents and V. E. Glushnev

AUTHOR'S CONCLUSIONS

A comparative study showed that the velocity of oxidizing cracking exceeds that of cracking in the absence of air. However, this regularity is only valid for temperatures not exceeding 700-720° C.

A rise of the concentration of oxygen in the air-hydrocarbon mixture within the limits investigated increases the reaction velocity, other conditions being equal.

Cracking of gasoline with air can be described by the equation for reactions of the first order. Equations for the dependence of the velocity constant (calculated by the constant for monomolecular reactions) upon temperature are given, and the energy of activation of cracking of gasoline with air and in the absence of air determined.

The decisive factors in the process of oxidizing cracking for high quality motor fuel are the concentration of oxygen and duration of the reaction.

By oxidizing cracking a high extent of conversion of the charge and increased yields of aromatics can be achieved at lower temperatures than those required in ordinary cracking.

THE voluminous literature on oxidation of hydrocarbons with oxygen of the air[1] pertains either to liquid phase oxidation at low temperatures of the order of 180-200°C. or to oxidation in the vapor phase; the basic purpose of these processes consists in preparation of oxygenated organic compounds, such as fatty acids, ethers, aldehydes and alcohols. Some authors term these processes oxidizing cracking. However, in accordance with the terminology established in the petroleum industry, oxidizing cracking should be regarded as a process aiming at preparation of gasoline.

During the last decade much study was reported in the literature on the mechanism of oxidation of hydrocarbons in the course of the performance of the engine, problems of detonation and of combustion of fuel. However, oxidizing vapor phase cracking for the production of high quality motor fuel, first suggested as a commercial scale method by K. Dubrovai, is almost neglected in the literature. Only in very recent time were the first studies published in the petroleum literature dealing directly with vapor phase oxidizing cracking and its products.

The first serious attempt at a kinetic study of the reaction of oxidizing cracking of petroleum hydrocarbons was carried out by Schultz and White[2]. These authors compared oxidizing cracking with cracking in the absence of air on the example of a fraction of Pennsylvania gasoline boiling within 150 and 204°C., and concluded that: (1) cracking with oxidation can be regarded as a method of accelerating the reaction of ordinary cracking, using lower temperatures, and (2) an increase of the concentration of oxygen in the air-hydrocarbon mixture at constant temperature increases the reaction velocity.

Later, N. D. Zelinskii and R. Ya. Levina[3] compared the chemical composition of liquid phase cracked gasolines with gasoline of oxidizing vapor phase cracking and established that: (1) oxidizing cracked gasoline is characterized by a high content of aromatics and considerably lower content of olefins and paraffins and (2) oxidizing cracked gasoline shows an appreciable content of cyclic hydrocarbons in general when compared to liquid phase cracked gasoline: 70-80% in the oxidizing cracked gasoline from a Dubrovai unit and 30-40% in liquid phase cracked gasoline from a Winkler-Koch unit.

Similar conclusions were drawn by A. D. Petrov and B. S. Gnyubkin[14], who investigated gasoline obtained by oxidizing cracking of peat tar in a Dubrovai unit under ordinary conditions. These authors stated that the gasoline prepared in this way contains about 60% aromatics, has an octane number of 87, and, with respect to its antiknock properties, exceeds the gasoline obtainable from the same charging stock by hydrogenation about 1.5 times.

The results for oxidizing cracked gasoline produced in semi-commercial Dubrovai units at 540-550°C. are shown in Table 1.

The oxidizing cracked gasoline is seen to consist predominantly of cyclic hydrocarbons, particularly aromatics. An exception is shown in the work of A. F. Dobryanskii and A. Bogomolov[7], who regard air under the conditions of thermal decompositions of petroleum products as unfavorable for the formation of aromatic hydrocarbons. The data of these authors were obtained in a limited number of experiments and require verification. In their experiments no preliminary vaporization was effected, and, according to the calculations of the present authors, the heating period did not exceed 10 sec., a period entirely insufficient for a favorable course of formation of aromatics. This point will be discussed in more detail in a subsequent communication.

The object of the experimental study reported here consisted in determination of the character and the extent of the effect exerted on the course of oxidizing cracking by the three most important factors—temperature, reaction time and concentration of oxygen. Determination of oxygenated compounds in the gaseous

TABLE 1—Chemical Composition of Oxidizing Cracked Gasoline

Fraction °C.	Sum of unsaturated & aromatics	Unsaturated from iodine numbers	Aromatics by difference
Petroleum gasoline investigated by N. D. Zelinskii & R. Ya. Levina[3]			
To 60	...	...	...
60- 95	96.7	55.7	41
95-122	75.6	44.8	30.8
122-150	62.4	45.0	16.4
150-200	...	...	...
Petroleum gasoline investigated by A. D. Petrov & B. S. Gnyubkin[4]			
To 60	...	...	...
60- 95	99	55.5	43.5
95-122	96	30.5	65.5
122-150	89.6	34.0	55.5
150-200	...	...	...
Petroleum gasoline investigated by K. K. Dubrovai & E. V. Glushnev[6]			
To 60	Almost exclusively olefins and dienes		
60- 95	99.6	65.3	34.3
95-122	81.5	60.0	21.5
122-150	64.5	44.3	10.2
150-200	41.0	32.0	9.0
Petroleum gasoline investigated by S. S. Nametkin & E. R. Robinzon[5]			
To 60	...	...	...
60- 95	...	...	...
95-122	84.5	67.7-66.4	17.5
122-150	...	...	...
150-200	...	...	...

This article is the sixth in a series of translations from Russian scientific literature which are being published in the TECHNICAL SECTION of National Petroleum News with the cooperation of the Petroleum Division of the American Chemical Society. The current article originally appeared in Izvestiya Akademii Nauk S.S.S.R., Otdelenie Tekhnichesk.kh Nauk (Bulletin of the Academy of Science of U.S.S.R., Technical Science Class) in 1939 (issue No. 3, pages 85-109).

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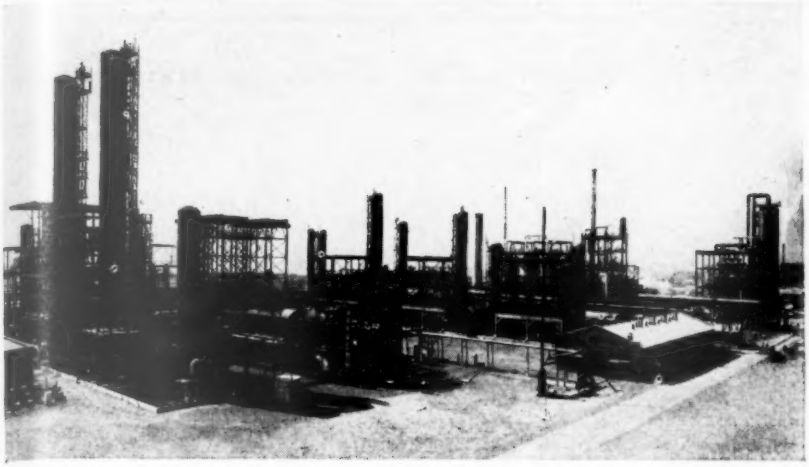

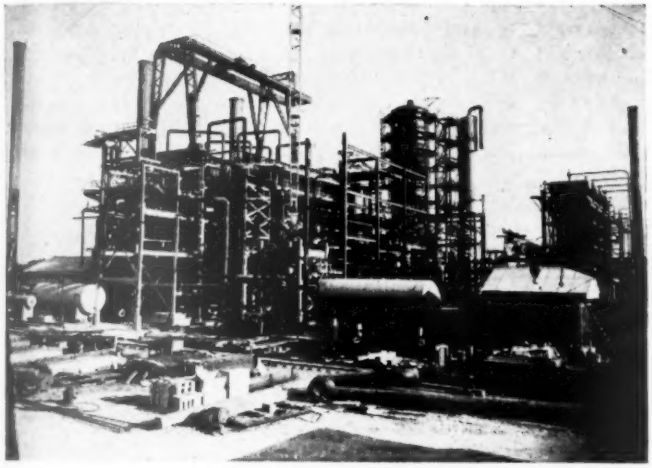

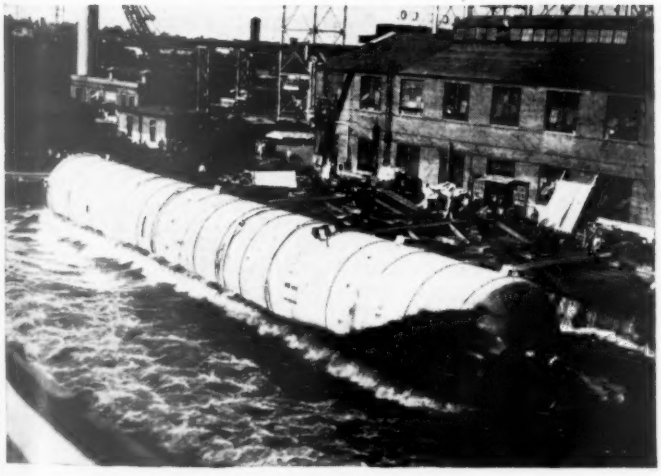

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phase is of great interest, as is the general distribution of oxygen in the reaction products, which can indicate, at least in the first approximation, the character of the reactions involved in oxidizing cracking.

The charging stocks included petroleum products of different molecular weights, as seen from Table 2. The gasoline fraction 100-160°C. was used to verify the conclusions of Schultz and White[2] concerning cracking with and without air. The fraction 182-247°C., "side-stream," a cracked kerosene usually obtained at the plant by secondary fractionation of cracked gasoline, was used for experiments on determination of the effect of the concentration of oxygen on the chemical composition of the products formed in oxidizing cracking. Finally, gas oil and mazut were cracked in order to investigate the formation of aromatics under conditions of pyrolysis in the presence of air.

Experimental Part

Apparatus. The cracking experiments were performed in iron reaction tubes kept in ordinary laboratory electrical furnaces. The volume of the reactors was either 443 or 4500 ml. The temperature was measured inside the reaction tube and its fluctuations along the length of the tube usually did not exceed 2-3°. An essential difference in comparison with the generally accepted method of procedure consisted in first preparing a mixture of oil vapors and air and then subjecting it to thermal decomposition, rather than charging the liquid stock directly to the reactor, as done, for instance, by A. F. Dobryanskii, according to the report of the Khimgaz plant for 1936. It is thought that charging the liquid to the reactor promotes coking and hinders the process. On the other hand, it also makes impossible the calculation of the reaction period and comparison with the data given in the literature.

The charging stock passed from a glass buret at a constant rate into a vaporizer and thence to the reactor. On the way to the latter, it was mixed with dry air charged at a predetermined rate.

Investigation of the cracked products. In the liquid cracked products specific gravity, molecular weight, refractive index with the Abbe apparatus were determined, and, in addition, the fractional composition by the method of Engler and the bromine or iodine number. In the products of pyrolysis of Surakhany mazut

TABLE 2—Physical Constants and Chemical Composition of the Starting Materials

Charge	Gasoline fraction, 100-160° C.	Gas oil a	Gas oil b	Straight run gas oil	Surakhany mazut
Physical constants:					
sp. gr.	0.7446	0.850	....	0.8536	0.8876
I.B.P., °C	100	182	....	130	219
mol. wt.	109	158	....	224.3	309.5
n(20/D)	1.4195	....	....	....	....
Chemical composition, %:					
unsaturated	....	....	....	....	paraffinic
aromatics	3	44	41.6	16.9	paraffinic
naphthenes	28.3	41.8	16.9	36.9	paraffinic
paraffins	63.4	13.7	41.5	46.2	....

TABLE 3—Oxidizing Cracking of the Gasoline Fraction 100-160° C.

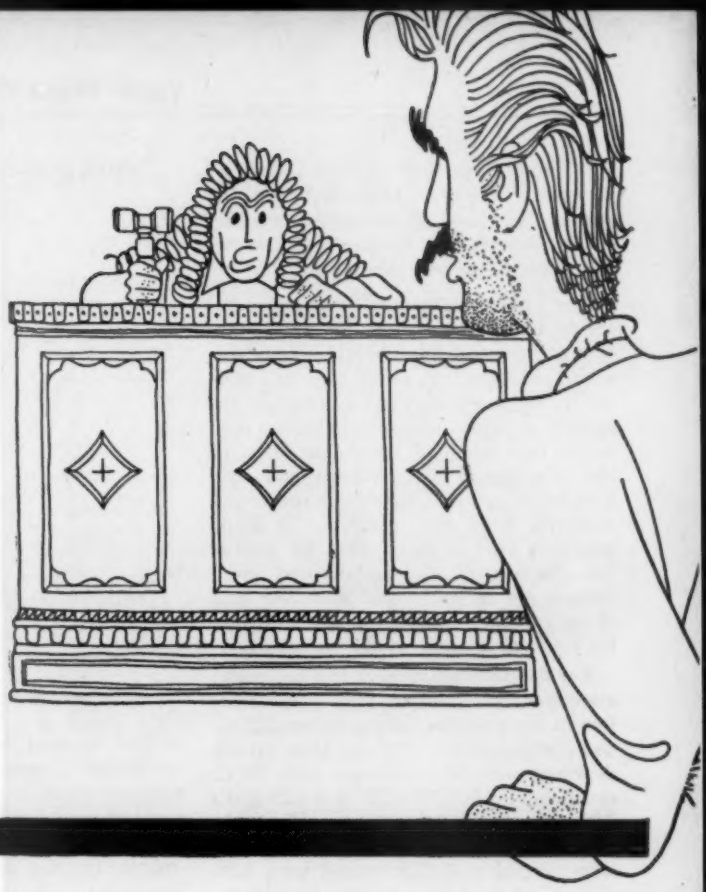
Expt. No.	EXPERIMENTAL SERIES NO. 1							
	1	2	3	4	5	6	7	8
Reaction temp., °C.	600	600	600	600	600	600	600	600
Oxygen, moles per 100 moles charge	2.8	4.3	7.1	8.5	9.95	11.4	12.8	14.2
Reaction period, sec.	14.0	13.45	12.94	11.92	11.87	11.97	11.73	10.9
Product of Pyrolysis								
d(15/4)	0.7337	0.7561	0.7273	0.751	0.734	0.732	0.724	0.756
Yield†	5.35	5.88	5.85	6.33	6.13	6.00	6.08	6.7
Gasoline, 200° C. E.P.								
d(15/4)	0.7556	0.7536	0.7559	0.7569	0.7562	0.7555	0.7591	0.7576
n_D15	1.4230	1.4225	1.4230	1.4235	1.4230	1.4230	1.4240	1.4240
Yield†	5.12	5.38	5.32	5.83	5.77	5.82	5.0	6.6
Chemical Composition of the Gas								
Sp. gr. (NTP)	1.0189	.....	1.0259	1.0235	1.0148	1.0277	1.0646	1.0272
Yield†	1.52	.....	1.43	2.14	1.7	1.38	1.56	1.7
C_3H_8* (% by vol.)	1.44	3.6	2.7	4.4	4.14	3.75	5.4	3.3
C_nH_n* (% by vol.)	13.6	18.5	20.3	22.9	21.5	22.9	23.1	22.8
C_2H_4* (% by vol.)	12.78	17	21	19	16.9	21.2	23.9	22.4
C_nH_{2n}* (% by vol.)	28	36.1	42.2	46	51.5	47.7	52.1	48.4
Formation of olefins‡								
Liquid products	1.1	1.1	1.1	1.3	1.32	1.36	1.2	1.6
Gas	1.6	2.1	2.32	3.2	3.4	2.5	2.4	3.0
Liquid + gas	2.7	3.2	3.42	4.5	4.7	3.9	3.6	4.6

Expt. No.	EXPERIMENTAL SERIES NO. 2					EXPERIMENTAL SERIES NO. 3				
	1	2	3	4	5	1	2	3	4	5
Reaction temp., °C	550	600	625	650	700	550	600	625	650	700
Oxygen, moles per 100 moles charge	8.5	8.5	8.5	8.5	8.5	0.00	0 00	0.00	0.00	0.00
Reaction period, sec.	14.87	13.16	12.72	12.08	10.17	20.8	18.7	15.1	11.1	11.7
Product of Pyrolysis										
d(15/4)	0.7631	0.751	0.726	0.748	0.778	..	.	.	..	...
Yield†	5.72	5.72	4.8	3.49	2.27	4.34	3.91	4.88	5.13	0.9
Gasoline, 200° C. E.P.										
d(15/4)	0.755	0.7569	0.7646	0.7703	0.7983	0.7502	0.7525	0.7553	0.7724	0.7953
n_D15	1.4230	1.4235	1.4310	1.4345	1.4565	1.4175	1.4240	1.4250	1.4270	1.4530
Yield†	5.44	5.26	4.46	2.93	1.81	4.28	3.78	4.43	4.2	0.66
Chemical Composition of Gas										
Sp. gr. (NTP)	1.0216	0.7572	1.0181	1.0016	0.9336	0.9976	1.0185	1.0164	1.008	0.8487
Yield†	0.43	0.8	1.53	2.04	2.95	0.173	1.02	1.68	3.26	5.38
C_3H_8* (% by vol.)	3.94	3.1	4.6	4.9	3.8	1.4	2.3	3.3	3.0	4.4
C_nH_n* (% by vol.)	17.5	22.2	23.9	40.1	22.2	18.5	21.6	22.1	22.9	14.4
C_2H_4* (% by vol.)	13.8	21	23.5	9.26	25.3	20.4	22.4	20.8	22.2	18.8
C_nH_{2n}* (% by vol.)	34.8	46.4	52	54	51.1	52	46.3	47	48.1	37.6
Formation of olefins‡										
Liquid products	0.77	1.13	1.14	0.8	0.6	0.46	0.77	1.0	1.3	0.2
Gas	0.57	2.28	2.4	4.2	7.6	0.11	1.8	2.8	5.9	6.1
Liquid + gas	1.34	3.4	3.54	5.0	8.2	0.57	2.5	3.8	7.2	6.3

*Calculated on the hydrocarbon portion of the gas. †Yield, % by wt. per 1 sec. of the reaction period. ‡Formation of olefins: content of unsaturates formed per 1 sec. of the reaction period, in moles per 100 moles charge.

F A M O U S

Caustic Comments



An accused criminal stood before the court. He smirked at the judge, Lord Bacon, and pleaded, "Your Highness ought to let me free. You and I are really relatives. You see, my name's Hogg, and Hogg's kin to Bacon."

"Not until it's hung," was Lord Bacon's caustic reply.

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and straight run gas oil, low molecular aromatics were also determined. For the gasoline obtained by oxidizing cracking of the side stream kerosene the chemical composition was determined.

The "physical method" recommended by A. F. Dobryanskii[8] for determination of benzene, toluene and xylene was used. It should be noted that this generally employed method is suitable for analysis of oxidizing cracked gasoline only in the case when all or at least most of the unsaturated hydrocarbons and oxygenated compounds have been previously removed from the gasoline. Sulfuric acid was used as the reagent for freeing the gasoline of the unsaturated compounds and it was found that 10% acid of sp. gr. 1.84 was completely sufficient for removal of most of the unsaturates.

For the determination of low molecular aromatics, the 150°C. end point fraction of the gasoline boiling below 225°C. was distilled under a 50 cm. long French dephlegmator into fractions with 70°C. end point, 70-95°, 95-120° and 120-150°. After determining the yields and specific gravities with a picnometer the fractions were recombined and treated with 10% acid of sp. gr. 1.84. The sludge was removed, the product neutralized, washed, dried, separated from polymers and again fractionated into cuts of the same boiling ranges as indicated above, thus giving products in which benzene, toluene and xylenes, respectively, were concentrated. These aromatics were determined from sp. gr. and the data recalculated for the initial stock. In addition, the content of benzene was, as a rule, checked by cryoscopical determination by the method of Jones[9]. Numerous experiments revealed almost complete agreement of the results obtained by the two methods.

TABLE 4—Cracking Velocity Constants of the Fraction 100-160° C.

Expt. No.	Reaction temp., °K	Moles oxygen per 100 moles charge	Reaction period, sec	Per cent by weight gasoline recovered P	Cracking velocity constant, K
2a	873	0.0	18.7	73.2	0.01666
1	873	2.8	14	75.5	0.02005
II	873	4.3	13.5	79.1	0.01741
3	873	7.1	12.94	77.3	0.01980
4	873	8.5	11.92	77.3	0.02158
5	873	9.95	11.87	74.7	0.02454
6	873	11.4	11.97	73.7	0.02540
7	873	12.8	11.73	74.4	0.02520
8	873	14.2	10.9	76.0	0.02513
1	823	8.5	14.87	86.9	0.0101
2	873	8.5	13.16	77.3	0.0195
3	898	8.5	12.72	62.5	0.0369
4	923	8.5	12.08	43.2	0.0360
5	973	8.5	10.17	23.8	0.1411
1	823	0.0	20.8	90.4	0.00484
2a	873	0.0	18.7	73.2	0.01666
3	898	0.0	15.1	73.8	0.02009
4	923	0.0	11.1	57.0	0.05050
5	973	0.0	11.7	10.4	0.19300

The method of Kattwinkel[10] was used for determination of unsaturated and aromatics in the gasolines; the contents of naphthenes was indicated by aniline points[11] and that of paraffins by subtracting the sum of unsaturated and aromatics. The extent of unsaturation of the gasoline was also indicated by the bromine number. For the kerosene and higher fractions the specific gravities were calculated for the compilation of the balance of the experiment.

For gas analysis, Hempel pipettes were used. Carbon dioxide was absorbed with potassium hydroxide, oxygen with alkaline pyrogallol, carbon monoxide with ammoniacal cuprous chloride. In some experiments the contents of benzene in the gas was determined by absorption of the vapors with a solution of nickel cyanide in ammonia, according to Dennis[12]. The unsaturated hydrocarbons were determined by absorption with bromine water. In addition, in the experiments in which gasoline was cracked, the gas was analyzed for the content of individual monoolefins (ethylene, propene, isobutene) by fractional absorption with sulfuric acid of differing concentrations[13]. Paraffins and hydrogen were analyzed by combustion in a quartz capillary over cupric oxide[14].

Calculations. The time during which the mixture of oil vapors and air remained in the cracking zone was calculated by dividing the volume of the reaction space by the average rate of flow of the mixture through the reactor at the temperature of the experiment.

The concentration of oxygen in the mixture was determined in moles per 100 moles charge, assuming a 21% content of

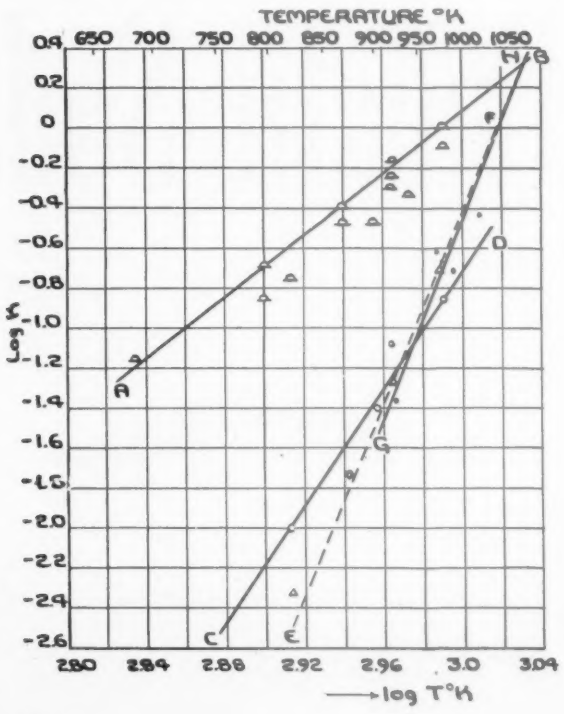

Fig. 1 (left)—Dependence of the cracking velocity constant on temperature. Curve A-B: Schultz and White cracking Pennsylvania gasoline (149-200° C.) in the presence of air. Curve C-D: cracking of the fraction 100-160° with air. Curve E-F: cracking of the fraction 100-160° without air. Curve G-H: Schultz and White cracking without air.

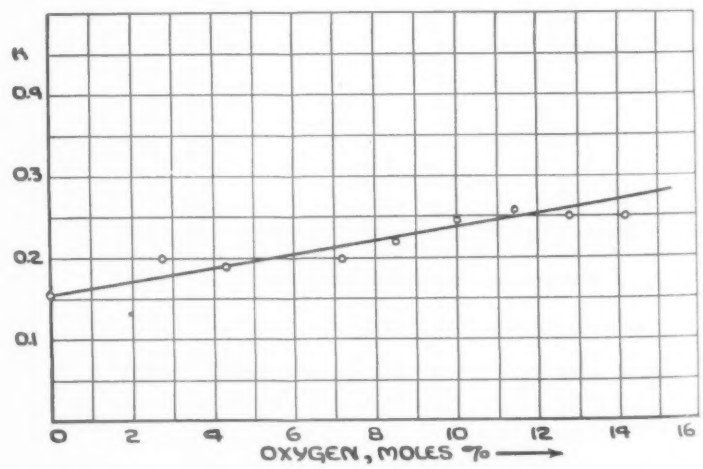

Fig. 2 (above)—Dependence of the cracking velocity constant upon the concentration of oxygen.

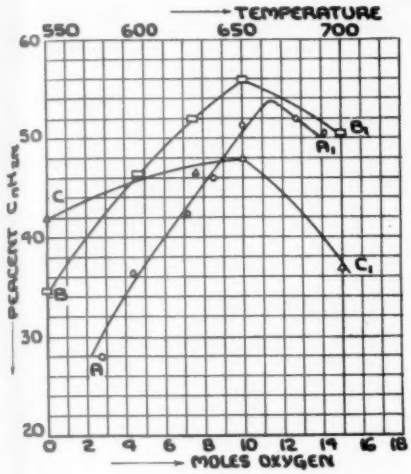

Fig. 3—Content of unsaturated hydrocarbons in the cracked gases in per cent by volume. Curve A-A_1: cracking with air at 600° C. Curve B-B_1: the same at 500-700° C. (concentration of oxygen in the mixture 8.5 per mole-%). Curve C-C_1: cracking without air at 550-700° C.

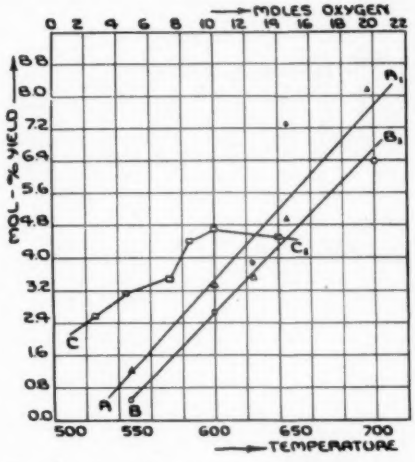

Fig. 4—Unsaturated hydrocarbons in the products of cracking of the fraction 100-160° C. formed in 1 sec. Curve A-A_1: cracking with air. Curve B-B_1: cracking without air. Curve C-C_1: cracking with air at 600°.

oxygen in the air. The cracking velocity constant K was calculated by the equation for monomolecular reactions, which was also used by Schultz and White.

This constant was only calculated for the 100-160°C. gasoline fraction, and the dependence of K upon the temperature of the experiments was compared with that given by the above named authors. For the other charging stocks arbitrary values of the reaction velocities were used, expressed either by the number of holes unsaturated formed at low extent of decomposition during 1 sec. reaction time by 100 moles charge, or by the percent of light fractions formed per unit time. The second method was based on the consideration that neither the equation for monomolecular reactions nor other existing empirically derived equations can be regarded at the present time as truly expressive of the regularities involved in the complex mechanism of the decomposition of high molecular hydrocarbons. Moreover, this calculation is convenient for the comparison of experimental data, especially those obtained in cracking in the presence of air.

Experimental Results

Cracking of the gasoline fraction. With the gasoline fraction 100-160°, which consisted predominantly of paraffins and naphthenes (Table 2) comparative experiments were performed of cracking with and without air at 550-700°C. In addition, a series of experiments were undertaken for the determination of the effect of the concentration of oxygen in the hydrocarbon-air mixture within 2.8 to 14.2 mole-percent at 600°C. on the formation of unsaturated from saturated hydrocarbons. The experimental conditions and analytical results of the products are shown in Table 3. The reaction velocity constants were calculated from the equation

$$K = 2.303/t \times \log 100/P \quad \ldots\ldots\ldots (1)$$

in which t is the reaction period, considering the change of volume, and P is percent converted stock. The velocity constants calculated are shown in Table 4.

Fig. 1 shows the functional dependence of log K upon log T°K. The cracking velocity constants for Pennsylvania gasoline are seen to be quite close to the cracking velocity constants of Grozny gasoline (the two gasolines are known to have close chemical compositions). However, the absolute values of the velocity constants of oxidizing cracking for the two gasolines differ greatly. The cause of this divergence is due to the fact that the concentration of oxygen used in the experiments of Schultz and White was almost five times as high as that used by the present authors. For this reason, the energies of activation E of oxidizing cracking of these gasolines differed, while the values of E for the reaction of cracking without air of the two gasolines in the experiments carried out under identical conditions were close.

The dependence of the velocity of oxidizing cracking upon temperature as determined in this study is expressed by

$$\log K' = 4.99 - 5661/T \pm 0.004 \quad (2)$$

whence the energy of activation of the cracking reactions, E, is 25,875 cals. per mole. The equation describing the dependence of the velocity of decomposition of the same fraction upon temperature in the absence of air is

$$K = 8229 - 9349/T \pm 02 \quad \ldots\ldots (3)$$

whence E is 42,727 cals. per mole.

In the experiments of Schultz and White, E for the oxidizing cracking of gasoline was found to be 10,350 cals. per mole and for non-oxidizing cracking 46,888 cals per mole. The experiments shown in Tables 3 and 4 and Figs. 1-5 reveal that cracking with air involves a more pronounced decomposition of saturated hydrocarbons than what takes place in cracking in the absence of air.

The reaction velocity of oxiding cracking greatly exceeds that of cracking without air (Fig. 1). However, the regularity is valid only for the temperature region not exceeding 700°C. Beyond this limit, the velocity of decomposition of hydrocarbons decreases and drops below that of ordinary pyrogenetic processes. The similarity of the straight lines obtained by Schultz and White and by the present authors (Fig. 1) serves as support for this view. The lines of Schultz and White intersect at 727°C., while those obtained in the present study at 677°C. In both cases the intersection occurs in a temperature region characteristic of pyrolysis. This points to the oxidizing cracking as an acceleration of ordinary cracking at lower temperatures. An increase of the concentration of oxygen in the mixture brings about a further acceleration of oxidizing cracking.

Fig. 2 shows the dependence of the

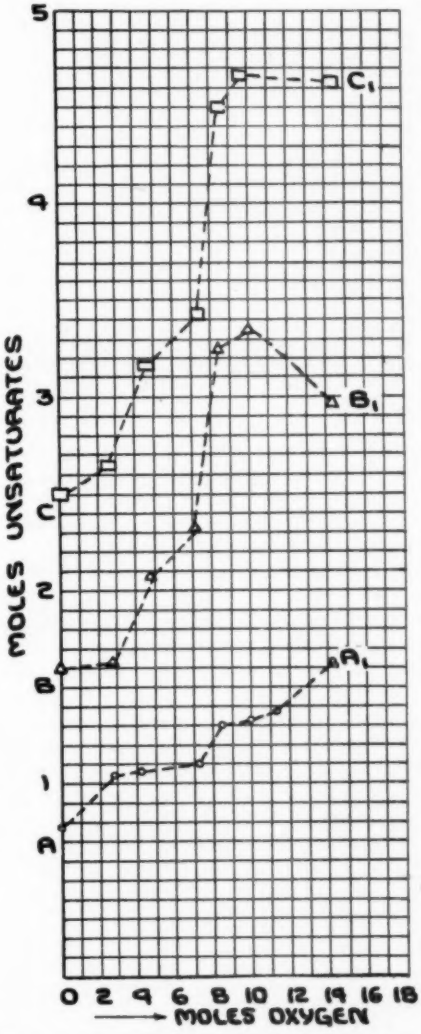

Fig. 5—Formation of unsaturated hydrocarbons by cracking of the gasoline fraction 100-160° C. at 600° C. Curve A-A_1: liquid products. Curve B-B_1: gaseous products. Curve C-C_1: liquid and gaseous products.

TABLE 5—Oxidizing Cracking of the Fraction 182-247° C.

	—EXPERIMENTAL SERIES NO. 1—				——EXPERIMENTAL SERIES NO. 2——						
Expt. no.	1	2	3	4	6	7	8	9	10	11	12
					Fraction with 225° C. E.P.						
Bromine no.	68.7	78.5	81.7	89.7	61.6	65.4	67.8	68.5	67.7	75.2	85.0
Aromatics & unsaturated, %											
On the fraction[1]	47.75	51.87	56.69	63.05	50.03	46.23	51.76	54.38	54.08	70.24	70.40
Increase[2]	6.43	10.55	15.37	21.73	8.71	4.91	10.44	13.06	12.76	28.92	29.08
Increase[3]	0.296	0.493	0.780	1.168	0.534	0.507	0.682	0.888	0.911	2.008	2.080
					Fraction 225-250° C.						
Bromine no.	65.1	65.0	69.0	69.9	56.16	53.7	56.85	64.1	57.6	63.2	...
Aromatics & unsaturated, %											
On the fraction[4]	48.55	45.38	45.78	51.81	50.44	42.64	58.80	50.15	50.65	50.94	54.39
Increase[2]	6.97	3.80	4.20	10.23	8.86	1.04	9.22	8.57	9.07	9.36	12.81
Increase[3]	0.321	0.172	0.213	0.550	0.536	....	0.602	0.579	0.647	0.650	0.360
Naphthenes, %											
On the fraction[4]	36.82	39.32	40.65	37.58	36.67	41.90	36.90	36.43	38.24	37.49	35.57
Decrease[2]	4.65	2.15	0.81	3.89	4.80	0.437	4.57	5.04	3.23	3.98	5.90
Decrease[3]	0.214	0.100	0.041	0.209	0.290	.....	0.298	0.340	0.230	0.270	0.240
Paraffins, %											
On the fraction[4]	14.33	15.30	13.56	10.61	12.89	15.48	12.3	13.42	11.11	11.57	10.04
[illegible]	2.62	1.65	3.39	6.34	4.05	1.47	4.65	3.53	5.84	5.38	6.91
Decrease[3]	0.120	0.077	0.172	0.240	0.245	0.091	0.303	0.238	0.417	0.370	0.500

	—EXPERIMENTAL SERIES NO. 3—							
Expt. no.	13	14	15	16	17	18	19	20
				Fraction with 225° C. E.P.				
Bromine no.	59.6	60.0	66.0	72.2	79.1	84.3	90.0	90.1
Aromatics & unsaturated, %								
On the fraction[1]	46.33	53.22	51.40	58.80	53.95	57.95	66.29	70.74
Increase[2]	5.01	11.90	10.08	17.48	12.63	16.63	24.97	29.42
Increase[3]	0.360	0.888	0.770	1.304	1.200	1.410	2.356	2.603
				Fraction 225-250° C.				
Bromine no.	60.5	62.3	61.4	63.9	64.2	69.1	74.0	74.1
Aromatics & unsaturated, %								
On the fraction[4]	51.01	49.78	51.50	53.69	53.81	53.37	55.82	57.31
Increase[2]	9.43	8.20	9.92	12.10	12.23	11.79	14.24	15.73
Increase[3]	0.678	0.612	0.781	0.903	0.107	0.100	1.343	1.392
Naphthenes, %								
On the fraction[4]	36.74	36.15	34.90	34.26	34.18	35.90	36.22	34.79
Decrease[2]	4.73	5.22	6.57	7.21	7.29	5.57	5.25	6.68
Decrease[3]	0.353	0.406	0.501	0.538	0.640	0.471	0.490	0.591
Paraffins, %								
On the fraction[4]	12.25	14.07	13.6	12.05	12.01	10.73	7.96	7.9
Decrease[2]	4.70	2.88	3.35	4.90	4.94	6.22	8.99	9.05
Decrease[3]	0.338	0.214	0.255	0.365	0.433	0.527	0.848	0.801

[1] On the fraction with 225° C. E.P.
[2] Increase or decrease of the amount of hydrocarbons in the fraction during the experimental period.
[3] Increase or decrease of the amount of hydrocarbons in the fraction for one second of the reaction period.
[4] On the fraction 225-250°C.

reaction velocity constant calculated by the equation for unimolecular reactions on the concentration of oxygen. A rise of this concentration up to 14 mole-% on the charge at a constant cracking temperature of 600°C. is seen to increase the reaction velocity.

Furthermore, according to Fig. 3, formation of unsaturated compounds in the gases of oxidizing cracking exceeds that observed in cracking without air. The rate of the reaction of oxidizing cracking, arbitrarily expressed by the number of moles of unsaturated compounds formed per 1 sec. of the reaction period from 100 moles of initial saturated hydrocarbons (under the condition of the extent of decomposition being less than 10%) also exceeded the reaction velocity of cracking in the absence of oxygen, as revealed by Fig. 4.

An increase of the concentration of oxygen in the mixture only increases the decomposition of saturated hydrocarbons. Fig. 5 clearly shows this accelerating effect, revealing that a rise of the concentration of oxygen from 2 to 15 mole-% at a constant temperature of 600° accelerated the decomposition of saturated and brought about a 65% increase of the unsaturated compounds in the liquid cracked products and a 100% increase in the gaseous products. The last mentioned fact points to a predominant decomposition occurring close to the ends of long aliphatic hydrocarbon chains in the presence of oxygen with resulting formation of low molecular gaseous olefins, while the rupture close to the middle of the chain is of subordinated significance. As the temperature increases and the concentration of oxygen rises, the point of chain rupture probably shifts toward the middle.

The value of the energy of activation determination in the study under report and by Schultz and White reveals that the reaction of oxidizing cracking of hydrocarbons, as compared to ordinary thermal dissociation of hydrocarbons, involves a considerably higher amount of energy and this energy can serve for activation and formation of new hydrocarbon chains.

Cracking of the fraction 182-247°C. The constants and chemical composition of this fraction and of the narrower cut 225-250°C. separated from it are shown in Table 2. The wider fraction 182-247°C. was used for three series of experiments at 540-700°C., in which the concentration of oxygen in the mixture varied from 15 to 50 mole-% on the charge. For the purpose of comparison, experiments without air were also performed with this fraction at 700°C.

The basic objective of these experiments consisted in following up the character of the changes of the chemical composition of the fraction 182-247°C., depending upon the temperature and the concentration of oxygen. The changes of the tail portion of the charging stock, 225-250°C., were investigated by determination of the chemical composition of the cracked products, for which purpose the latter were fractionated, separating one cut with 225°C. end point and a subsequent cut boiling within 225 and 250°C. The results are shown in Tables 5, 6, 7 and 8.

The data of Tables 5 and 6 and Fig. 6 certify that a rise of the cracking temperature and of the concentration of oxygen involves a continuous rise of the sum of the aromatics and unsaturated formed in the 225°C. end point portion of the product. A similar regularity is observed

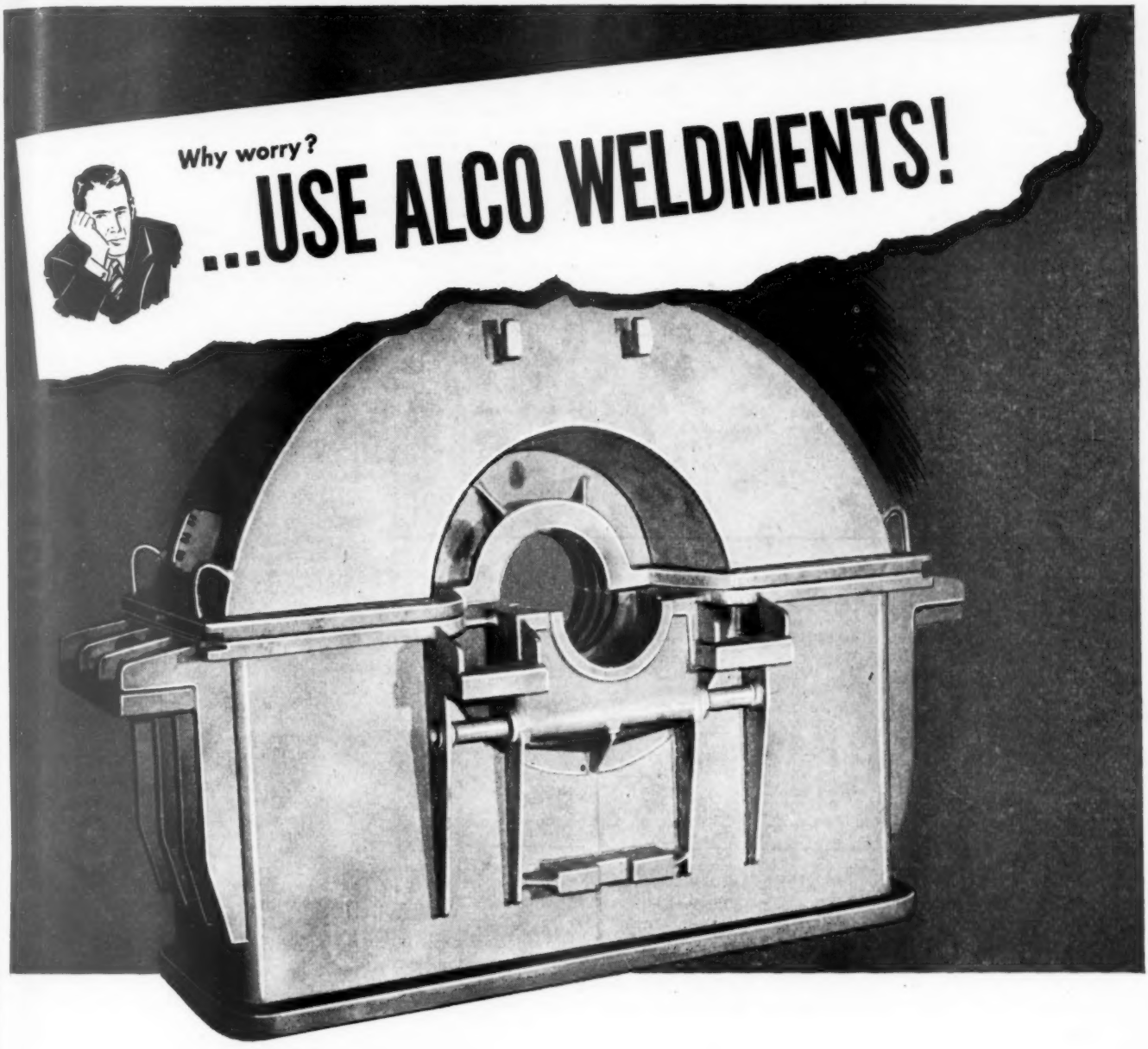

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TABLE 6—Oxidizing Cracking of the Fraction 182-247°C. at 700°C.

Expt. no.	Oxygen mole % on the charge	Duration of the heating, sec	Fraction with 225° C. E.P. Bromine no.	Fraction with 225° C. E.P. Increase*	Fraction 225-250° C Bromine no.	Fraction 225-250° C Aromatics & Unsaturated Increase*	Fraction 225-250° C Naphthenes & Paraffins Decrease**	
2	0	27	....	....	50.1	0.341	0.079	0.263
4	13	18.6	89.7	1.168	69.9	0.550	0.209	0.240
12	29	13.9	85.0	2.080	....	0.936	0.424	0.500
20	48	11.3	91.0	2.603	74.1	1.392	0.590	0.801

* Increase of the amount of aromatics and unsaturates in the fraction per 1 sec reaction time.
** Decrease of the amount of hydrocarbons in the fraction per 1 sec of the reaction period.

TABLE 7—Oxidizing Cracking of the Fraction 182-247° at 700° C.

Expt. No.	Reaction Period, °C.	Oxygen Moles-% On the Charge	Reaction Period, Secs.	Fraction with 150°C. E.P. d(15/4)	% by wt. on Charge	Bromine No.	Rate of % by wt. per Sec.
22	700	0.0	26.7	0.7869	11.47	127	0.429
21	700	0.0	27.0	0.7875	10.89	119	0.403
4	700	13.0	18.6	0.7897	11.24	135	0.604
12	700	29.0	13.9	0.7883	10.35	132	0.744
20	700	48.0	11.3	0.7765	12.61	152	1.110

TABLE 8—Oxidizing Cracking of Gas Oil

Expt. No.	Fraction with 150°C. E.P. d(15/4)	Yield, % by wt. on fraction with 225°C. E.P.	Yield, % by wt. on charge	% by wt. low molecular aromatics	% by wt. unsaturated hydro-carbons
1	0.7545	23.6	6.56	8.41	29.2
2	0.7772	63.9	19.48	19.60	39.0
3	0.7865	65.7	15.94	38.74	29.0
4	0.8117	67.3	17.16	42.86	30.0
5	0.7740	69.3	19.30	44.28	33.0
6	0.8400	76.6	16.69	65.44	22.0
7	0.8470	78.5	16.64	59.20	23.2
8	0.8487	85.9	12.88	38.10	19.0
9	0.7782	66.4	15.61	46.00	....
10	0.8290	69.7	10.50	67.90	37.4
11	0.7970	76.7	14.49	54.70	41.6

also for the 225-250°C. fraction of the products. The data of Tables 5 and 6 pertaining to this fraction. as well as Fig. 7, show an increase of the rate of conversion of paraffins and naphthenes with rise of the concentration of oxygen, other conditions being equal. It is thought plausible that decomposition of hydrocarbon chains under conditions of oxidizing cracking occurs not only at the carbon-to-hydrogen bond; but also at the carbon-to-carbon bonds, and is the more pronounced the higher is the concentration of oxygen within certain limits.

(Editor's Note: The balance of this article detailing the experiments on the vapor phase oxidizing cracking of oil products will be presented in the December 5 issue of the NPN Technical Section.)

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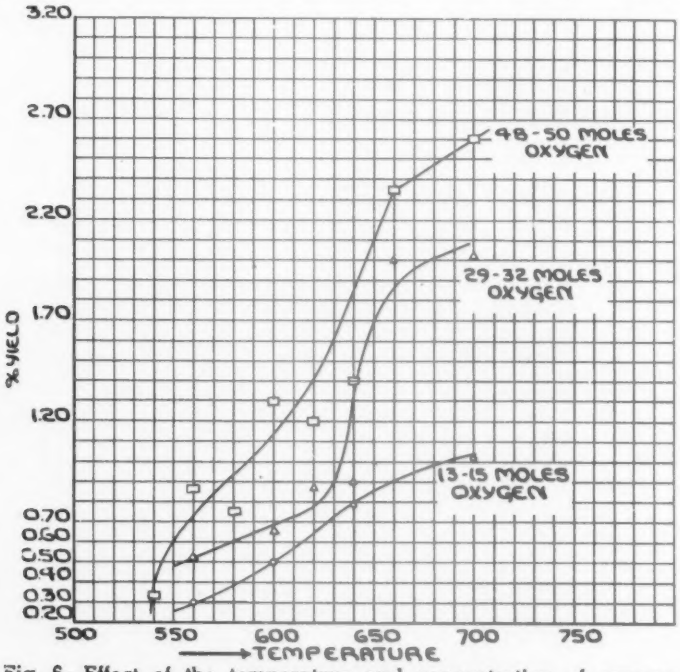

Fig. 6—Effect of the temperature and concentration of oxygen on the yield of aromatics and unsaturated hydrocarbons in the fraction up to 225° C. per 1 sec. reaction period.

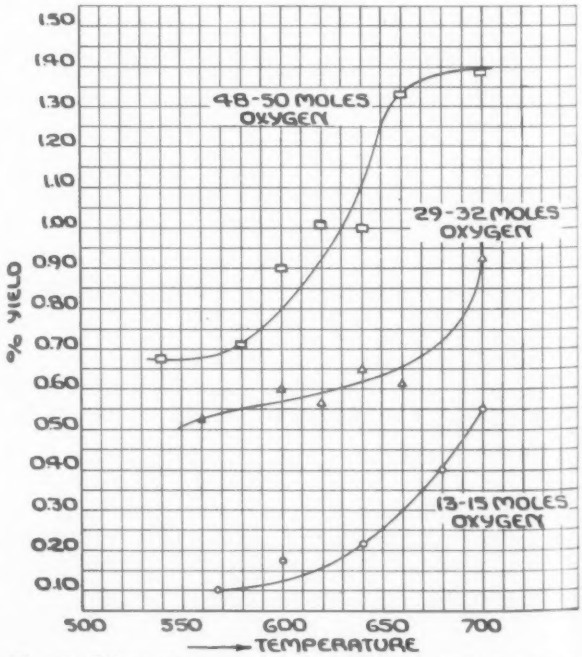

Fig. 7—Effect of temperature and concentration of oxygen on the yield of aromatics and unsaturated hydrocarbons in the fraction 225-250° C. per 1 sec.

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Manufacture, Regeneration Of Fischer-Tropsch Catalyst

By Lt. R. C. Aldrich, U.S.N.R.

The manufacture and regeneration of the catalyst is a most important factor in the successful operations of a Fischer-Tropsch process, a U. S. military personnel mission reported as a contribution to the work of the Technical Industrial Intelligence Committee in Germany.

Its report, "Fischer-Tropsch Process", (TIIC Index 373), is based on the firsthand study of the operation of a plant at Harnes, France. It includes a section describing in detail the methods used in the manufacture and regeneration of the catalyst and the accompanying chemical reactions. The catalyst studied was the normal Co-Mg-Th-Kieselguhr type used almost exclusively in Fischer-Tropsch commercial operations. This portion of the report is published in full below.

THE manufacture of catalyst is one of the most difficult and important features of the Fischer-Tropsch process. Except for sulphur removal in the feed gas, it is the operation which has the greatest effect on good plant operation. Along with this step goes the regeneration of spent catalyst, which is equally important.

All modern Fischer-Tropsch units have a special department for manufacturing and regenerating catalyst. This department is staffed with well-trained chemists who have at their disposal the most modern control equipment. For this reason the investment and operating costs of the catalyst department form a sizeable part of the total plant installation.

At the Carrieres-Kuhlmann plant at Harnes, France, the Fischer-Tropsch unit employs 120 men as operating personnel. This plant should be able to produce 350 bbls. of total liquid daily. Of the 120 men, 40 are employed in catalyst manufacture and regeneration. There are also 80 men not included in the 120 total doing full time maintenance.

Description of Raw Materials

The raw materials used at Harnes are pure cobalt metal, magnesium oxide, thorium oxide and Kieselguhr. These produce new catalyst, as opposed to the regeneration of old catalyst, which is a separate operation. The percentage by weight of the finished catalyst (in the non-hydrogenated form) is as follows:

Co	18.0%
MgO	1.8
ThO_2	0.9
Kieselguhr	79.3
	100.0%

It must be stressed that the above analysis is in the unreduced form prior to hydrogenation; after the catalyst is hydrogenated it is extremely pyroforic and cannot be analyzed.

Other chemical agents used are nitric acid (36° Be) and sodium carbonate (10% strength). The exact quantities of these used cannot be definitely stated but it is approximately 40-50 kg. of HNO_3 and 90 kg. of Na_2CO_3 to produce 100 kg. of finished catalyst.

Purity of Raw Materials

The raw materials used must be extremely pure. Small traces of impurities will poison the catalyst, e.g. CaO and Fe.

The cobalt must be at least 99% pure. The remaining 1% is either copper or nickel. Before the war the Kuhlmann company obtained their cobalt from the Belgian Congo. This ore in its native state is known as Katanga. At the start of the war this supply was cut off, and another source in North Africa was used. The latter was not as pure as Katanga and had to be concentrated by a process similar to the Parks process. The ore is dissolved in nitric acid and passed over a bed of pure cobalt. The pure cobalt displaces the copper and nickel in the nitrate solution. The two latter elements settle to the bottom while the cobalt nitrate is removed from the top.

The thorium oxide cannot contain even traces of lead or phosphorus. The calcium oxide content must be less than 0.2% by weight.

The Kieselguhr used must be of a certain type. It must not contain iron or lime. The SiO_2 content must exceed 92%. The sand content cannot exceed but a few percent. All organic matter must be removed by roasting at 800° C. However, the temperature must not be greatly exceeded as the structure of the particles will be destroyed.

The German Kieselguhr from Kieselguhr-Industrie-Hannover No. 120 is one of the best. It contains some impurities but has excellent size properties.

The Johns-Manville "Filtracel" will work well. Its chemical composition is purer than the German but its size is not as accurately controlled.

The French are currently getting their Kieselguhr from the central part of France (Murat). It is not as good as either of the above but will work reasonably well. The greatest difficulty is apparently in air blowing the material in such a way as to remove the sand and not incur great losses.

Finally the nitric acid used must be made from distilled water in order to avoid all traces of CaO.

Description of Catalyst Manufacture

All of the raw materials except the Kieselguhr are placed in one of three mixing tanks. These tanks are so arranged that two of them can quickly and simultaneously dump their contents into the third. Along with the raw materials in the first tank is put the required

Hydrogen sulfide was removed from the Fischer-Tropsch synthesis gas by passing the gas through towers filled with trays of iron oxide and sawdust. Shown above is such a gas purification unit, after an Allied bombing, at a synthetic oil plant at Kamen-Dortmund

Bomb destruction of a synthetic oil gas cooler at the Fischer-Tropsch plant at Hoesch Benzine

quantity of 36° Be nitric acid. Mechanical agitation is used to assist the reaction. Distilled water, up to 1000 liters, is also added. The acid quantity is 20% in excess of that required theoretically to nitrate the magnesium and thorium oxides and the cobalt. The reactions in this operation are:

$$ThO_2 + 4HNO_3 \rightarrow Th(NO_3)_4 + 2H_2O$$
$$MgO + 2HNO_3 \rightarrow Mg(NO_3)_2 + H_2O$$
$$Co + 2HNO_3 \rightarrow Co(NO_3)_2 + H_2$$

In the second tank is put 10% strength sodium carbonate and up to 1000 liters of distilled water. The contents of this tank and the nitrated products of the first one now are quickly and simultaneously dumped into a third large tank. This tank has mechanical agitation and is heated up to 100° C. The pH of the resulting mixture is 7.2, slightly on the alkaline side.

This is most important, as under no circumstances must the formation of bicarbonates occur. The boiling temperature also aids in releasing CO_2 (especially with the cobalt salt) so that the final reactions are:

$$Co(NO_3)_2 + Na_2CO_3 + xH_2O \rightarrow Co(OH)_2 + CO_2 + 2NaNO_3 + (x-1)H_2O$$
$$Mg(NO_3)_2 + Na_2CO_3 \rightarrow MgCO_3 + 2NaNO_3$$
$$Th(NO_3)_4 + 2Na_2CO_3 \rightarrow Th(CO_3)_2 + 4NaNO_3$$

The Kieselguhr meanwhile has been heated carefully to 800° C. to remove all organic metal. It is now added to the mixture in the third tank and thoroughly stirred and agitated. The presence of any bicarbonates would tend to destroy the efficiency of the Kieselguhr as a supporting medium and for that reason all the latter must be removed before the Kieselguhr enters the third tank.

The slurry is now sent through a series of washes with distilled water. The first is through a plate type filter press. It is important that this filtration be done very quickly. At Harnes there are two of these in parallel. Next, the slurry enters a horizontal mixing tank with a screw type agitator. More distilled water is added here.

After suitable stirring, the slurry is fed into an Oliver rotary type filter where the extraneous water is removed. Following this the slurry enters an extruding type press (called "Strangpresse" by the Germans). Here the water content is reduced to 6-8%. The dryer is steam heated and maintained at a temperature of 120° C. The catalyst rests on moving belts in the dryer. The time of passage is two hours.

The catalyst is now ready for sizing. The optimum size is that of a pea. It is put into a unit with a screen bottom, 4 mm. mesh size, and a sweeping broom device forces the catalyst through the mesh. It falls into a vibrating inclined screen which removed the dust and fines. These are collected and returned to the horizontal mixing drum for reprocessing. The sized catalyst particles are now ready for reduction by hydrogenation.

The pellets are placed in a special type of container having conical ends piped up to a closed hydrogen circuit. The pellets rest on a screen tray and can hence be easily exposed to the hot gas. The hydrogen is heated in a furnace to 350° C (in Germany 400° C) before entering the container. Since the reduction of the oxides and carbonates produces water, the exit gas must be dried. This is done by passing successively through water cooled coils, ammonia cooled coils and finally silica gel, returning to the hydrogen heater for recirculation. This step takes approximately ¼ hr. The reactions here are:

$$Co(OH)_2 + H_2 \rightarrow Co + 2H_2O \quad (70\%)$$
$$Co(OH)_2 + \tfrac{1}{2}H_2 \rightarrow CoO + H_2O \quad (30\%)$$
$$2Mg(CO_3) + 2H_2 \rightarrow 2MgO + 2CO_2 + 2H_2O$$
$$Th(CO_3)_2 + 2H_2 \rightarrow ThO_2 + 2CO_2 + 2H_2O$$

When the reaction is complete the reactor is cooled and filled with CO_2. The contents are transferred to a closed bucket container and placed in the reactor, still in a CO_2 atmosphere. If air comes in contact with the reduced catalyst a violent fire will occur, as the material is extremely pyroforic. The CO_2 is purged from the system as soon as the hydrocarbon feed enters the reactor.

Regeneration of Spent Catalyst

The spent catalyst, containing cobalt, cobalt oxide, magnesium oxide, thorium oxide and Kieselguhr, is dumped into a tank with 36° Be nitric acid. A small quantity of sulphur will also have accumulated from impure feed gas.

The quantities of magnesium and calcium silicate and sulphur in the spent catalyst are very small, resulting from the decomposition of the Kieselguhr, but are very important and must be removed.

The quantity of nitric acid required is that which will completely nitrate all the oxides and silicate. It is found by experimental procedures. As a test, the nitrate material when roasted must

Iron Catalyst Not Being Used Commercially

While considerable development work had been carried on in the use of a new iron catalyst for the Fischer-Tropsch operations in Germany, in actual commercial operations the so-called cobalt catalyst was being generally used, the U. S. Technical Oil Mission learned. It was understood, however, that the iron catalyst was to be used in the Fischer-Tropsch plant the Germans were planning to build in Italy.

In the development work the suggested iron catalyst consisted of: 100 parts of iron, 2.5-4 parts of copper, 10 parts of lime and 15 parts of kieselguhr. The catalyst was made up from the nitrates by precipitation with carbon dioxide, it was reported.

appear gray and not black. Otherwise the cobalt oxide has not been completely converted to cobalt nitrate. Mechanical agitation aids the reaction.

The slurry is pumped through a plate type filter press, No. 1, where the bulk of the spent Kieselguhr is removed. This is not recovered. The cake is washed by distilled water to remove all valuable nitrates.

This solution, after leaving filter press No. 1, enters another tank with mechanical agitation. Enough sodium carbonate is added to result in a pH of 4.2. The reaction is approximately as follows:

$$Co(NO_3)_2 + Ca(NO_3)_2 + Th(NO_3)_4 + Mg(NO_3)_2 + xNa_2CO_3 \rightarrow Co(NO_3)_2 + Ca(NO_3)_2 + Th(CO_3)_2 + MgCO_3 + xNa_2NO_3 + Na_2SO_4$$ and traces of $Fe(OH)$

It should be noted that the cobalt and calcium nitrates are untouched as long as the pH remains 4.2. This allows for their separation from the insoluble carbonates.

The resulting slurry now enters a plate type filter press, No. 2, where the magnesum and thorium carbonates and the sodium sulphate is removed as spent cake. The solution of cobalt and calcium nitrate then goes to a settling tank into which is pumped a solution of sodium fluoride and distilled water with the resulting reaction:

$$Co(NO_3)_2 + Ca(NO_3)_2 + 2NaF + xH_2O \rightarrow Co(NO_3)_2 + CaF_2 - 2NaNO_3 + xH_2O$$

The resulting slurry goes to a final plate type filter press, No. 3, where the calcium fluoride is removed and discarded. The purified cobalt nitrate is now ready to use again as part of the regenerated catalyst.

The spent cake from filter press No. 2 consisting of $Fe_2(OH)_6$, $MgCO_3$, $Th(CO_3)_2$ and Na_2SO_4 now goes to a tank with agitator and is nitrated with 36° Be HNO_3. From here the slurry goes to another tank where a controlled quantity of sodium hydroxide, 20 grams per liter, is added. In so doing a double thorium salt is formed, $Na_2SO_4 + SO_3ThO_2$, which is soluble. The iron and magnesium nitrates are converted to insoluble hydroxides. The double salt will not decompose at ambient temperatures.

Filter press No. 4 removes the $Fe_2(OH)_6$ and $Mg(OH)_2$. The solution of the double salt now goes to a steam heated tank where its temperature is raised to above 80° C. This causes the double salt to decompose into $Th(OH)_4$ and Na_2SO_4. The former is removed as spent cake in filter press No. 5 and is ready to use again as part of the regenerated catalyst. The sodium sulfate solution is discarded.

No attempt is made to recover the magnesium hydroxide as its value is not sufficiently great to warrant the effort.

Fischer-Tropsch Plants Gave Nazis Diesel, Motor Fuels, Lubricants

HIGH cetane number Fischer-Tropsch diesel fuel produced in France and Germany during the war was being blended with inferior coal tar from the low temperature carbonization of coal, for use as fuel in farm tractors and heavy trucks.

Fischer-Tropsch gasoline was being sold direct to the public and was in great demand, although its octane number was only around 50. The butane gas which was also made was compressed into bottles at around 300 psi. and used as fuel for gas-driven automobiles.

The heavy wax produced in the operation was taken by various chemical concerns for manufacture of paints, varnishes and polish.

From time to time during the war, the output of Fischer-Tropsch plants was varied to make special chemical products, lubricating oils, greases and so on, the highly paraffinic nature of the liquid products making it a valuable base for developments of this kind.

The above general picture of operations by the Germans of the Fischer-Tropsch plants in France and Germany is contained in a preliminary TIIC report on this subject by Capt. H. A. Schade, U. S. N.; Lt. Col. E. Foran, U. S. A., and Lt. R. C. Aldrich, U. S. N. R. Their report "Fischer-Tropsch Process" (Index No. 373) was part of a study which included the inspection of the Carrieres-Kuhlmann plant at Harnes, France. Following is a resume of the report:

Coke Is Basic Raw Material

This plant was designed for a basic output of 20,000 tons a year but at the time of the inspection by the TIIC mission it was producing only 36 tons a day, equivalent to 288 U. S. barrels. Basic raw material for this plant was coke from the high temperature carbonization of French coal. After breaking up, the coke was taken by skip hoist to the water gas generators, which were of conventional design.

Analysis of the water gas was: CO, 40%; H_2, 50%; CO_2, 5%; N_2 and CH_4 5%. One third of the gas as produced was passed over a catalyst of FeO at 500°C. with steam, resulting in a product rich in H_2 and CO_2. This gas was blended with the rest of the original water gas, the analysis of the final blend being; CO, 27%; H_2, 54%; CO_2, 14%; N_2 and CH_4, 5%.

Three steps were taken to remove sulphur from the gas, as the Fischer-Tropsch catalyst is very sensitive to sulphur poisoning. The first step is a countercurrent wash with ammonia water to remove H_2S. This is done in two towers. The second step consists in passing the gas through boxes containing trays of Fe_2O_4 and sawdust, described as the typical old fashioned method used by city gas works. Final step is the removal of organic sulphur compounds in two towers filled with a catalyst of FeO and Na_2CO_3 at 200-300°C. The catalyst is in eight beds one meter thick. Both towers are in series.

Gas Compressed to 3 psi

The gas ready for synthesis is compressed to 3 psi prior to entering the reactors in order to overcome the pressure drop in the operation. The 24 reactors are all cooled by a hot-water-steam system so arranged that each pair of reactors shares a common header and control valve.

The synthesis reaction is described as being extremely exothermic. Approximately 7000 Btu results from the production of 1 lb.-mol of liquid product.

The cooling system for the reactors was found by the technical mission to be one of the most important details of the installation. This was for two reasons: (1) the reaction must occur at a definite temperature range (in this case 200°C. ± 3°) because if the temperature is lower no reaction will occur and if it is higher the products will disintegrate into methane; (2) the catalyst itself is an extremely poor conductor of heat.

As a result the mean path of heat travel from any catalyst particle to the cooling surface is kept below 2 mm. This prevents a hot spot from occurring in the catalyst bed. To obtain a sufficient cooling capacity a very complicated design was worked out for the reactors.

Design of Reactors

The reactors are described as essentially a square box consisting of 600 thin baffles pierced by 600 tubes filled with hot water. The water temperature is maintained by controlling the steam pressure on the system by an automatic relief valve.

Each reactor has a total surface of 5000 sq. meters and weighs 50 metric tons. The resulting density of the reactor is approximately 60% of that of solid steel. The catalyst fills the voids between baffles and tubes. To remove the catalyst for regeneration a compressed air jet is used.

Of the 24 reactors, 16 are normally used for the first pass. The effluent from these is cooled and condensed and the resulting heavy product removed. The gases are next sent to the remaining 8 reactors for the second pass, which produces a lighter product than the first pass. As before, the products are condensed and separated. The remaining gas contains considerable gasoline and butane. These are collected in an activated charcoal system and later steam stripped. The propane and butane are sold separately.

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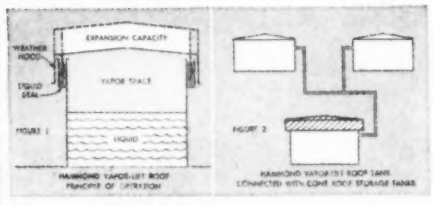

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'O.X.O.' Process Made Higher Alcohols From Fischer-Tropsch Olefins

THE German scientists had been doing important development work on the manufacture of higher alcohols in connection with their operation of Fischer-Tropsch plants, the American and British petroleum technologists learned on their inspection of the Ruhr valley plants. While the immediate use of these higher alcohols was to be for the manufacture of soaps, study was also being made of their use as source materials for a great variety of chemical products, including edible fats.

A plant to use one of these processes, "O.X.O." (German military code name) has been about completed at the Fischer-Tropsch installation at Holten when the war ended. This plant was to treat C_{12} to C_{17} olefins, converting them first to aldehydes by passing them, together with sulphur-free water gas, over ordinary Fischer-Tropsch catalyst. The aldehydes with pure hydrogen were then passed over a nickel catalyst to convert them into alcohols.

The development work included the dehydrogenation of C_{16} to C_{18} cuts from Fischer-Tropsch operations to olefins for use in the "O.X.O." plant.

These operations are described in a CIOS report by Col. J. A. Oriel of the British Ministry of Fuel and Power, "Report on Visit to Oil Targets in the Ruhr and Hanover Areas" (TIIC Index No. 3). Following is a summary of this report:

An "O.X.O." plant was part of the operation of the Ruhr Chemie installation at Holten and, while the plant was very badly hit and little or nothing of technical value could be obtained by an examination of the rubble, most of the drawings were available in the basement. From them data on the "O.X.O." process was secured.

The Fischer-Tropsch plant was conventional, with the Dubbs cracking plant utilized for the preparation of olefins, and a certain amount of work was going on on polymerization and aromatization. The Fischer-Tropsch plant used the normal catalyst consisting of:

100 parts of Cobalt
5 parts of Thorium
8 parts of Magnesium
180/200 parts of Kieselguhr

The Kieselguhr came from the Hannover area and the production of catalyst for the whole of the Fischer-Tropsch plants in the Ruhr was of the order of 4 tons (in terms of cobalt) per day.

The suggested iron catalyst was to consist of:

100 parts of Iron
2.5/4 parts of Copper
10 parts of Lime
15 parts of Kieselguhr

The catalyst was made from the nitrates by precipitation with carbon dioxide. This catalyst had not been made on a large scale up to the time of our visit but was looked upon as being suitable material.

There were obvious signs of considerable building activity at certain parts of the plant where they were evidently constructing cracking plants, combined probably with polymerization, but these plants had not been completed.

A considerable amount of laboratory work was being carried out on the dehydrogenation of the paraffins for the manufacture of "O.X.O." feed stocks and lubricating oils.

For some time they had worked on dehydrogenation of propane and butane, using a conventional aluminum chromium catalyst and it was alleged that the addition of 0.2% of cobalt reduced carbon formation. The dehydrogenation was being carried out at 590°C. and approximately atmospheric pressure. Their conversion was 24% per pass and, using 250 cc. of catalyst, they dehydrogenated 20 litres of butane per hour. The conversion was reduced after three months to 18% per pass. None of this work was of very high caliber.

Then they went on to the dehydrogenation of C_{16} to C_{18} cuts for use in the "O.X.O." plant. The catalyst in this case was thoria and chromia. The method alleged to have been adopted was as follows:

Method of Preparing Catalyst

Silicon carbide was treated with nitric acid to remove impurities, dried and heated to 650°C. A solution of thorium nitrate and chromium nitrate was then made up as follows: 21 grams of thoria as nitrate and 7 grams of chromia as nitrate were dissolved in water to make up a 3% solution. Two hundred cc. of cleaned silicon carbide, equivalent to 280 grams, were then placed in a rotating pot at 250°C., the pot being inclined at an angle of 45° to the vertical. The 3% solution mentioned above was then sprayed into the pot and the whole took four or five hours to be sprayed. The salts were claimed to be deposited in this way on the carborundum and the granules were heated slowly to 520°C., and lastly to 850°C., in a muffle furnace for two hours, when the catalyst was ready.

The catalyst was then transferred to a tube and at 560°C. hydrogen was passed over it at a rate of 200 liters/hour for 5 minutes. Then this was followed

Alcohol unit of the Ruhr-Chemie organization synthetic oil plant, comparatively untouched by bombs. This plant was said to be operating under the new "O.X.O." process for making alcohol from ethylene; first converting the ethylene into aldehydes, which, together with pure hydrogen, were then passed over a nickel catalyst to convert them to alcohols

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by nitrogen and the whole tube evacuated to 20 mm. of mercury. The C_{16} to C_{18} material was then introduced at the rate of 150 cc. of liquid per hour. The catalyst life was said to be three months and the yield was 15% to olefins C_{16} to C_{18}; 6% to olefins lower than C_{16}; 2 or 3% to gas and 0.5% to carbon, the remainder being unchanged. In order to improve this, barium oxide was added to the carborundum before the addition of the thoria and chromia; 12 grams of barium oxide were added to the catalyst containing 21 grams of thoria and 7 grams of chromia but the results were inconclusive.

The "O.X.O." Process

The information on the process was given by Dr. Landgraff and the patents in connection with the process were all taken out in the name of the Ruhr Chemie.

The work originally commenced in connection with a study to convert ethylene into aldehyde and the raw material used was an ethylene cut containing even as low as 20% ethylene. It was stated that a dilute mixture was even better than a concentrated mixture of ethylene, because the reaction is a fairly active one.

The work started in the gas phase at a pressure of 160 atmospheres, using the usual Fischer-Tropsch cobalt catalyst.

Note A: The general type of reaction to cover this synthesis, as also those using the higher olefins mentioned later, would seem to be:

$$\underset{\text{Ethylene}}{C_2H_4} + CO + H_2 \rightarrow \underset{\text{Propyl aldehyde}}{CH_3CH_2CHO}$$

Work went on using α-butylene and butadiene, and claims were made that adipic acid could be made using this process but no evidence was forthcoming.

Harold V. Atwell, The Texas Co., Beacon, N. Y., (center) with two members of the British mission in the alcohol unit of the Fischer-Tropsch plant at Moers

Note B: Possible reactions would be:

$$\underset{\alpha\text{-butylene}}{CH_3-CH_2-CH=CH_2} + 2CO + H_2 \rightarrow \underset{\text{Hexanedial}}{CHO(CH_2)_4CHO}$$

or

$$\underset{\text{Butadiene}}{CH_2=CH-CH=CH_2} + 2CO + 2H_2 \rightarrow \underset{\text{Hexanedial}}{CHO(CH_2)_4CHO}$$

$$\underset{\text{Hexanedial}}{CHO(CH_2)_4CHO} + O_2 \rightarrow \underset{\text{Adipic acid}}{COOH(CH_2)_4COOH}$$

Instead of hexanedial, cyclohexane might be formed by ring closure, splitting off water and picking up two hydrogen atoms. This gives adipic acid readily on oxidation.

The bulk of the work was carried out on two cuts of olefins ranging from C_{11} to C_{17}, which cuts for experimental purposes were sent to Holten from the Ruhr Chemie. These were further separated into four cuts as follows: C_{11}-C_{12}, C_{13}-C_{14}, C_{15}-C_{16}, and C_{17}. These cuts, which contained about 40% olefins, the balance being paraffins, were treated separately. It will be apparent from the process (see Note A) that a carbon atom was added to each cut so that the end products were aldehydes and alcohols from C_{12} to C_{18}.

The catalyst used, as stated, was the ordinary Fischer-Tropsch catalyst, but magnesium was excluded if at all possible. The olefins were passed, together with sulphur-free water gas containing 39 parts of carbon monoxide to 45 parts of hydrogen, over the catalyst, the temperature in the first stage being 135°C. and the pressure 150 atm., the temperatures

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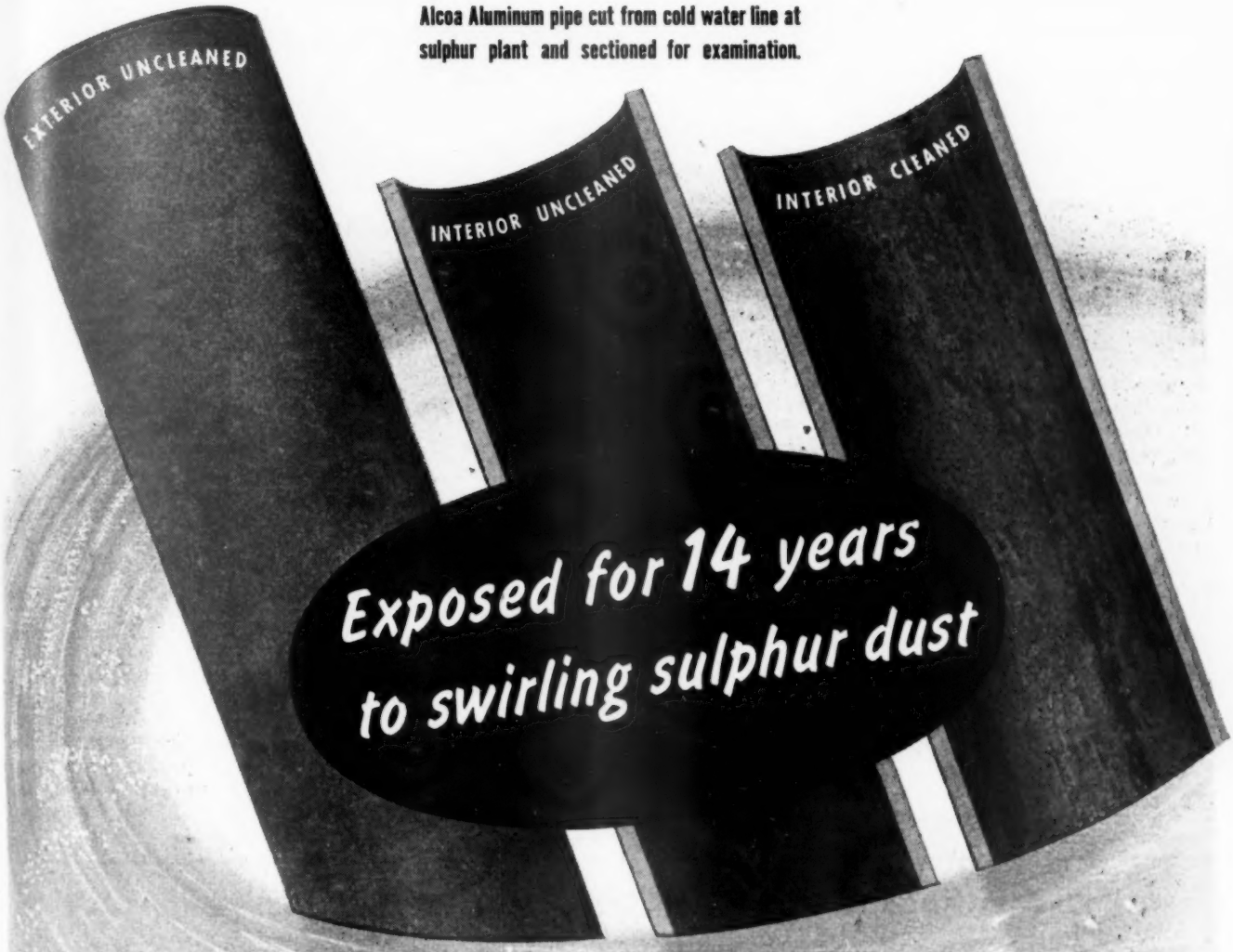

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being controlled by means of steam pressure. The process was intermittent, each cycle taking 20 minutes.

Byproducts Removed by Distillation

After the material had been in contact with the catalyst it was filtered through "filter stone" and then distilled to remove any byproducts. The aldehydes produced were distilled under vacuum at about 180°C., using a vacuum of 2 to 5 mm. of mercury, absolute. The bottoms were secondary alcohols, esters, etc. Distillation was carried out in a batch system and was not continuous.

The aldehydes were then passed, together with pure hydrogen, over a nickel catalyst to convert them into alcohols. The temperature was 180°C. and the pressure the same as for the first reaction.

At the time it was intended to supply the finished alcohols to Henkel for soap manufacture but a schematic arrangement indicated the alcohols were intended for making sulphonic soaps. In spite of heavy bombing and the apparent failure to get the Fischer-Tropsch plant at Holten working, the whole of the plant for this "O.X.O." process had been built without any priority and was almost in condition to commence operations. Construction had commenced in 1939-40 and was carried on as and when possible. This factor may have affected the economics of the process.

NEW BOOKS FOR THE REFINER

First General Treatise On Refining Since the War

American Petroleum Refining, by H. S. Bell; 6 x 9 in., 619 pages, stiff cloth binding, $7.50.

The first comprehensive work covering the subject of petroleum refining to be published since the start of the war is *American Petroleum Refining*, by H. S. Bell, consulting engineer of New York. The author's long experience in this field is to be seen from the fact that this is his third edition of this text, the first being brought out in 1923, the second in 1930.

This present edition is similar in style and treatment of the subject to the earlier ones and includes brief descriptions of the newer processes and methods, with data on standard refinery engineering practice. It is well illustrated with charts, flow diagrams and photographs.

The new special processes for motor fuel production which were applied during the war to aviation gasoline are described and illustrated, including alkylation, isomerization, thermal and catalytic polymerization, hydrogenation and dehydrogenation. The chapter on catalytic cracking, which is brought up through the war period, is authored by E. R. Smoley and V. O. Bowles of the Lummus Co. Four commercial processes are described; Houdry, Thermofor, Fluid and Cycloversion. The theory of solvent extraction of lubricating oils is presented and the principal processes described briefly. The chapters on dewaxing include improved centrifugal separation and solvent methods as well as conventional dewaxing.

The material on standard refinery engineering practice includes chapters on refinery site and arrangement of the plant, shell stills, pipe heaters, condensers and heat exchangers, packaging and storage of products and materials, among others. The book includes theoretical data on distillation, heat transfer, fractionation, cracking, solvent extraction, filtration, evaporation losses and pumping of oil. The chapters on the chemical and physical properties of petroleum are by T. T. Gray and D. Drogin.

Future problems which may face the petroleum industry are dealt with in a chapter discussing possible sources of oil and methods of synthesizing petroleum products.

Copies of *American Petroleum Refining* may be ordered from the Book Department of NATIONAL PETROLEUM NEWS, 1213 West Third Street, Cleveland 13. Price, postpaid, is $7.50 a copy (plus 3% sales tax in Ohio).

First Listing of Official Reports by Technical Missions On Refineries and Synthetic Oil Plants in Germany

BELOW are the titles of those reports of the first group submitted by the Technical Industrial Intelligence Committee (TIIC) which have been selected as being of most interest to the petroleum refiners in this country. Some of these reports are by Army and Navy groups of TIIC and by members of the British mission, as well as by the teams of the U. S. petroleum technologists who went to Germany. The reports listed here are the selections of Bureau of Mines and PAW officials who are most familiar with the work of the oil teams.

There are 377 reports listed in the complete first index of the data obtained by the various groups on their inspection visits in Germany, and they cover many scientific fields. Many of the reports listed here are preliminary. More complete listings will be issued later and these later reports also will contain more detailed technical information on processes and methods used by German industries.

Copies of all the original reports will be available as soon as they can be indexed and duplicated in quantities. The index shows the number of pages in the original report and its price. Copies of the reports may be ordered through the Office of the Publication Board, Dept. of Commerce, Washington, which requests that payment be made by check or money order payable to the Secretary of Commerce. This first complete index and copies of indexes subsequently issued may be secured without cost by notifying the Office of the Publication Board.

Title of Report	Pgs.	Index No.	Cost
Preliminary Oil Team Report on I. G. Farbenindustrie, Heidelberg. (Information on method of preparation of aviation gasoline.)	5	2	$.10
Report on a Visit to Oil Targets in the Ruhr and Hannover Areas, 4 to 21 April, '45, by Col. J. A. Oriel. (Gives plans, processes, formulas)	2	3	.10
Preliminary Oil Team Reports on Ammoniakwerke Merseburg, G.M.B.H. Plant of I. G. Farbenindustrie A. G. at Leuna, Germany. (Manufacturing synthetic aviation fuel, motor fuel, lubricating oil, fixed nitrogen, synthetic alcohols. Brown coal used as principal starting material.)	3	7	.10
Interrogation of Dr. Müller Conradi, I. G. Farbenindustrie—(Synthetic lubricating oil, CO and H_2 reaction products, isooctane, and Oppanol, a polyisobutane.)	6	9	.10
Statistics of German Production, Consumption and Stocks of Liquid Fuels, Rubber and Strategic Chemicals	16	10	.25

(Continued on P. R-932)

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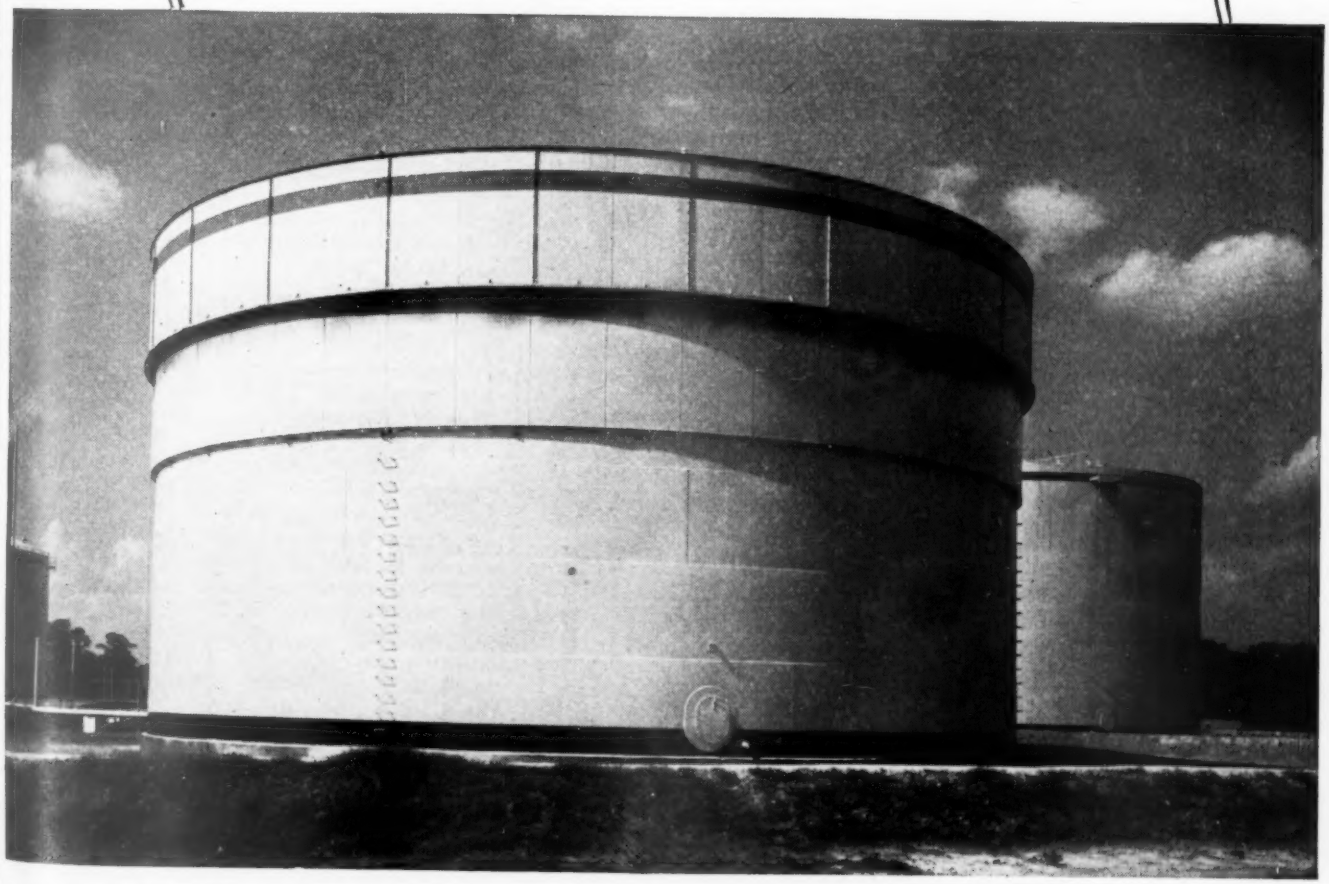

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Title of Report	Pgs.	Index No.	Cost
Investigation of Ruhr Synthetic Oil Plants, Preliminary Progress Report. (Details on Fischer-Tropsch process, hydrogenation, carbonization and gasification, interlinking of coal and chemical industries.)	9	17	.10
Dr. Butefish, Director of I. G. Farbenindustrie and Member of its Executive Technical Committee, Previously at Leuna, and an expert on Coal Hydrogenation.	4	19	.10
Dr. Julius Walter Reppe, Acetylene Chemistry Investigation of research laboratory. (Mentions reduction of acetylene requirement for butadiene in Buna; Periston, Koresin and Densodrin, a polyvinyl octodecylether for leather treatment.)	2	21	.10
Gelsenburg A. G.—Bituminous Coal Hydrogenating Plant	4	27	.10
Visit to Oil Centers in Leuna, Lutzekendorf, Zeitz, Bohlen, Strassfurt, & Factories in Russian Occupied Territories. (Hydrogenation of brown coal and its tar, naphtha dehydrogenation, alkylation processes, synthetic oils, Fischer-Tropsch.)	6	38	.10
Plant of Chemische Werke Huls, Huls, Germany. (Inspection of Synthetic Rubber Plant—Describes Acetylene process.)	8	226	.10
Polhoehe Measurement of Lubricating Oil. (Method of testing similar to viscosity index.)	4	280	.10
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Wartime Research on Synthetic Fuels, Kaiser Wilhelm Institut Fur Kohlnforschung. (Isoparaffin synthesis.)	8	289	.10
I. G. Farbenindustrie Mainkur-Hoechst. (Crude oil, miscellaneous chemical products.)	33	292	.25
Dachs 1 Lubricating Oil Plant, Porta, Germany. (Inspection of underground lubricating oil plants, using topped crude oil in Hannover area.)	8	293	.10
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German Torpedo Motor Fluid (Ingoline).	13	326	.25
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Steinkohlen-Bergwerk Rheinpreussen Moers-Meerbeck—Fuels and Lubricants, CIOS Target No. 30/5.05. (Fischer-Tropsch Plant.)	153	367	1.00
Gesellschaft Fur Linde's Eismachinen Hollriegelskreuth—Fuels and Lubricants CIOS Target No. 30/9.15. (Discussion of commercial manufacture of oxygen and nitrogen and of low-temperature separation of hydrocarbon gases—Latter field has obvious interest to petroleum technologists. Certain new processes for manufacture of gasoline for Fischer-Tropsch synthesis or hydrogenation make use of oxygen instead of air.)	28	368	.25
French Shale Oil Industry	61	372	.50
The Fischer-Tropsch Process	28	373	.25

* These reports have not been received by the Office of the Publications Board. When received they will be placed on supplementary lists.

Keeping Up With the News

By N.P.N. Special Writer

This series is prepared in an effort to correlate current information on certain of the important happenings in scientific and industrial fields in such a manner that its present and future relationship to the petroleum industry may be more clearly understood.

As is often the case, topics considered in this issue are not directly related. The synthetic rubber situation is discussed, chiefly with an eye to the future, and a summary is given of Carbide and Carbon's chemicals from petroleum. Lignite resources and their potential relationship to petroleum substitutes are surveyed.

The author of this series is a chemical engineer in the employ of the research subsidiary of one of the larger oil companies. His duties include a continuous survey of the current technical and economic journals in the many fields now related to petroleum operations.

Synthetic Rubber

The Office of Rubber Reserve, in a recent announcement, has revealed some significant facts. First of all, it appears that present plans now call for the production of only 655,000 long tons of synthetic rubber in the next 12 months, of which 550,000 tons will be GR-S (Buna-S), 75,000 tons will be GR-I (Butyl), and 30,000 tons will be GR-M (Neoprene).

Total demand is expected to approximate 1,000,000 long tons, 100,000 tons for export. Some 130,000 tons of GR-S and 15,000 tons of Butyl will be withdrawn from inventory. Plans evidently call for the use of 200,000 long tons of natural rubber, to be supplied from imports along with the amount required to build up the natural rubber stockpile from 100,000 to 150,000 long tons. The stockpile of GR-S will be left at 70,000 long tons.

The figure of 550,000 long tons for GR-S production may yet be subject to change for political reasons, but it is of particular interest in the light of a recent statement by John L. Collyer, president of the B. F. Goodrich Co.

"Synthetic rubber can make a major contribution in limiting the extent to which prices for natural rubber increase. Today, however, synthetic rubber costs and prices are complicated by a problem of base-material costs. Approximately half our present total synthetic rubber capacity is based on alcohol butadiene and the balance on petroleum butadiene . . .

The cost of synthetic rubber from grain alcohol is above 40 cents a pound, while that produced from petroleum is about 14 cents a pound, exclusive of amortization and depreciation costs.

"As long as our total needs for synthetic rubber are substantially above 500,000 tons annually, continued use of grain alcohol may keep the average cost of synthetic rubber as high as 30 cents a pound, compared with a prewar condition in which natural rubber could be laid down in New York and sold at a fair profit at 12 cents a pound.

"When this need falls below 500,000 tons a year, our total synthetic requirements can be based on petroleum butadiene, and synthetic rubber can then exercise its influence on natural rubber prices."

It is evident, therefore, that a realistic effort is being made both to adjust synthetic rubber production to a situation which will permit the use of quantities of soon-to-be-available natural rubber and, more important, to eliminate high-cost production so that synthetic rubber may have a real chance.

Unfortunately, these plans are likely to run afoul of the powerful congressional farm bloc, since synthetic rubber (or rather butadiene) production was a major consumer of grain alcohol (and hence grain) during the recent war — so much so that a Government subsidy was required to permit the synthetic rubber so produced to be used for civilian goods without raising their price.

It is certain that this subsidy ought to be dropped soon unless it is continued as a means for protecting synthetic rubber against competition with natural. The farm bloc, of course, can be counted upon to fight for continuance; its efforts in the 1942 controversy between petroleum-butadiene and alcohol-butadiene may easily be recalled. This group is also just as certain to demand that subsidized alcohol-butadiene be given "its share" of even a reduced program.

In regard to natural rubber, reports from the Far East indicate that stockpiles left by the Japanese in the East Indies, Malaya, Indo-China, and Thailand (Siam) probably exceed 500,000 long tons and may even be as high as 750,000 tons. Production in 1946 has been estimated at over 800,000 long tons—possibly 1,000,000. Shortage of shipping space might prove a bottleneck to U.S. receipts, but officials are not likely to let this interfere with real needs.

Prices at first will not be low; the British Military Administration in Singapore has set up an organization with sole authority to buy rubber at a fixed price of 17.75 cents per pound for prime grades, about double the 1940 production cost. This rubber will cost about 25.5 cents per pound in New York, three cents over the OPA ceiling price, indicating: (1) no imports, (2) a subsidy, or (3) an increase in the price ceiling. The first alternative can be ruled out, of course.

The whole situation is complicated by the need for international trade if true world prosperity is to be attained, countered by the necessity for insuring (through maintenance of a synthetic rubber industry) that this nation's rubber supply will never again be cut off.

An over-all rubber policy that will deal with the long-range future of the domestic synthetic rubber industry is currently being studied by a Government inter-agency committee headed by William L. Batt, WPB vice chairman. When this committee presents its report, before December 1, more light may be shed on the picture.

Carbide and Carbon

It is with more than idle interest that the petroleum and chemical industries survey the latest catalogue[1] of a company whose name has long been almost synonymous with "chemicals from petroleum"—the Carbide and Carbon Chemicals Corporation. The previous edition of this catalogue was issued in 1942, shortly after the entry of this country into the war. While the present list was prepared before the recent termination of hostilities, the changes which may be noted are indicative of some of the advances in aliphatic chemistry which were occasioned by the war.

In the words of the editors, this

(1) Anon., *Synthetic Organic Chemicals*, Carbide and Carbon Chemicals Corp. (New York), Twelfth Edition, 1945.

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catalogue, with its twenty chapters on the properties and uses of important organic chemicals and related substances, and its tables of physical properties, "is more than ever an important reference manual of industrial aliphatic organic chemistry." Five new chapters were added to the book, which lists about 200 products, 84 more than in the previous edition.

Space permits only a bare listing of the chapters on the important groups of chemicals described. These include alcohols, glycols, polyethylene glycols, hydroxyethyl cellulose, ethers and oxides, glycol-ethers, esters, plasticizers, ketones, aldehydes, acetals, organic acids, anhydrides, chlorine compounds, nitrogen compounds, sulfur compounds, wetting agents, activated carbons, hydrocarbons, and synthetic resins.

All of the compounds which have made Carbide famous are described: methanol, ethanol, allyl alcohol, 2-ethylbutanol, ethylene glycol, "Carbowax," the "Cellosolves," the "Carbitols," ethylene oxide, the many acetates, acetone, methyl isobutyl ketone, mesityl oxide, butyraldehyde, acetic acid, butyric acid, acetic anhydride, ethylene dichloride, ethylene chlorohydrin, 1,1,2-trichlorethane, the ethanolamines, the "Tergitols," butadiene, the "Vinylite" resins, "Vinyon fiber," polyethylene resins, and others.

The technical-economic story behind the commercial development of even a few of these products would fill many volumes—if they could be written, which is unlikely, since quite a few of Carbide's products are evidently produced by secret, unpatented processes, the details of which are closely guarded. In many instances, incidentally, these "secrets" are based upon engineering "know-how" rather than on absolutely new methods, but in any case such processes are not described in any detail in the literature.

The Carbide and Carbon Chemicals Corp. was organized in 1920, three years after its parent company, Union Carbide and Carbon, consolidated with the Prest-O-Lite Co. and the Linde Air Products Co. Its history, however, dates back to the Mellon Institute researches begun for Prest-O-Lite in 1914, but anyone attempting (as did the writer, once) to analyze its patent structure runs into a veritable maze, for patents granted prior to 1929 were evidently issued to individuals on Carbide's staff (for later assignment, apparently) rather than assigned directly to the corporation.

Carbide and Carbon has always fascinated petroleum companies through its evident ability to make money from petroleum by-products. Recent figures are not available, but as long ago as 1941 it was said that

its So. Charleston, W. Va., plant alone consumed 15,000,000 cu. ft. per day of mixed hydrocarbon gases, while the Whiting, Indiana, plant used 4,000,000 cu. ft. per day. Not even an out-dated estimate is available for the large, new plant at Texas City, Texas.

By no means does all the credit for the production of chemicals from petroleum belong to Carbide—Jersey Standard, Shell, The Dow Chemical Co., the Monsanto Chemical Co., Phillips, Continental, Union Oil, The Texas Co., Indiana Standard, California Standard, Gulf, and numerous others were also pioneers in this field or are active participants at present.

All of this testifies to what is by now an accepted fact: that petroleum is becoming more and more a chemical raw material, even for the production of bulk products such as gasoline. Certain newspaper writers have rashly predicted that the use of atomic energy may someday eliminate petroleum's fuel uses entirely. This can hardly be foreseen, but, even if it could, the chemical uses of petroleum are more than likely to remain and to muttiply.

Lignite

While the use of atomic energy, as mentioned, may eventually make worries over the exhaustion of petroleum and natural gas seem futile, it is of immediate comfort to note the encouraging advances in the development of substitutes for these materials from other substances which are, at least potentially, in far more abundant supply.

One of these abundant materials is lignite, often called "brown coal." According to geologists, lignite appears early in the continuous series of geological processes by which coals are believed to have been formed, following peat in this series and coming before the bituminous coals. "Most lignites are soft, friable or crumbly, have low specific gravity, and comparatively high primary porosity. They contain large quantities of water."(2)

Some American lignites are apparently harder to handle than the German brown coals, whose "mud-like consistency" differs from the "woody" nature of such lignites as are found in Texas. The latter are hard to dry commercially, becoming easily reduced to a powder, although new processes are said to overcome this drawback.

"Lump coal cannot be produced from (Texas) lignite. When (Texas) lignite is heated in a retort, it disintegrates to a powder. Neither does 'retorting' yield any by-products of economic value"; even the best gas produced is said to have only 415 B. t.u. per cu. ft. Except with asphaltic binders (8-10%), Texas lignite can not be briquetted; "the cost of this amount of asphalt renders briquetting generally unprofitable."(2)

All domestic lignites are not identical, of course, but their higher moisture contents, lower heating values, and more rapid deterioration on storage have so far rendered them far less desirable commercially than bituminous coal.

According to testimony presented in 1943 before the O'Mahoney Senate subcommittee, domestic reserves of lignite approximated 939 billion tons on Jan. 1, 1942, 99.9% of the estimated original reserve. At the 1941 rate of production, about 3,000,000 tons per year, this reserve would last almost indefinitely (313,000 years, a meaningless figure). It is obvious, therefore, that production could rise very considerably without fear of exhausting domestic lignite reserves which, incidentally, comprise 30% of total domestic reserves of all ranks of coal.

Most of the domestic reserve of lignite is located in N. Dakota (600 billion tons) and Montana (315.5 billion tons), but Texas contains an estimated 23 billion tons, and S. Dakota has about one billion tons. Geologic maps also show "probable" or known deposits in Louisiana, Arkansas, Mississippi, Tennessee, Alabama, and Washington. It is interesting to note that Canadian lignite resources may exceed 100 billion tons and that lignite deposits also occur in Alaska.

In itself, lignite does not appear to offer much potential competition to petroleum and natural gas at anywhere near present price levels, unless its technology advances considerably. What is of particular interest, however, is the possibility of preparing synthetic liquid and gaseous fuels and other "petroleum products" from lignite, either by hydrogenation or the Synthine (Fischer-Tropsch) process.

Phases of this topic have been discussed before in this series.(3) It is evident that no present methods of synthesis using coal of any variety can compete in this country with petroleum and natural gas at their present prices, although the use of the Synthine process (when it is fully developed) may eventually bring costs down to a difference of only a few cents per gallon of gasoline, for example.

It is the possible eventual use of this process for coal which makes so interesting the recent report on Texas resources which has already been quoted.(2) This report also contains highly pertinent data on petroleum, natural gas, and petroleum chemicals, but its timeliness goes beyond these and other basic materials.

As this series has noted, it is apparent that Synthine plants will soon be built in Texas and elsewhere to make use of presently-abundant supplies of low-cost natural gas. The day may come when these supplies are either no longer available in sufficient quantities or when other demands have increased the value of gas at the well to a level where further use for petroleum synthesis would be unprofitable.

When and if this period is reached, nearby lignite deposits may come into the picture. A commercial-sized unit based on Bureau of Mines' research has already been erected by the University of North Dakota for tests on the carbonization and gasification of noncoking coals such as lignite,(4) and work on this and similar processes indicate that economics alone bar immediate competition with petroleum and natural gas. The research program of the Bureau of Mines and other groups will shortly add other data on the subject, which will certainly be received with interest by the petroleum industry, which itself is active in this field.

(2) Drummond, L. (Editor), *Texas Looks Ahead, Volume I, The Resources of Texas*, University of Texas (Austin), 1944.

(3) Anon., *NATIONAL PETROLEUM NEWS, Technical Section*, 36, No. 31, R-564; No. 39, R-884 (1944), "Keeping Up With the News—Gasoline from Coal; 'Synthetic' Natural Gas."

(4) Anon., *Business Week* No. 834, 47 (1945), "Lignite for Gas."

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WIDENING HORIZONS

Views on Personnel, Management and Economic as Well as Technological Developments in Petroleum Refining and Natural Gas Processing: Comment from Readers Is Invited

Our "Spoils" of War with Germany Is the Know-How of Their Processes

EVEN in the war just ended the spoils of battle too often were the loot of the towns and of homes and the carrying off to slavery of human beings. Contrast that with the spoils of war of our own Armies as they overran France and Germany in the final stages of the conflict.

In place of the wanton destroyers and looters, a small army of scientists and technicians, including a group from our own oil industry, followed the troops. On the heels of the soldiers, and in some cases before the fighting stopped, they entered the factories, refineries and synthetic oil plants, along with other industrial establishments run by the Germans. They were searching not for tools and machinery and raw materials to cart away; but for the records and data and photographs that would show how the Germans were producing their fuels and lubricants and explosives and essential chemicals. This data, literally tons of it, is now being screened and analyzed and, even in the original form, much of it is now being made available to all interested parties in this country and England. Review articles on much of this early material are published in this issue of the NPN TECHNICAL SECTION.

Since the Germans throughout the war were confronted with a shortage of natural raw materials, they were supplying most of their essential wartime products by synthesis. Some of their scientific developments will be of value to the petroleum industry in this country, which, looking into the distant future, is planning research in the production of fuels and lubricants from substitute materials for petroleum.

In their great need for raw materials for chemical manufacture, the Germans also had gone extensively into the chemistry of acetylene and had found new methods for the manufacture of this important base for plastics and chemical products. One such method included the arc cracking of hydrocarbon gases from hydrogenation units and natural gas wells. Along the same line, the Germans had developed a method for making the higher alcohols, another important source material for chemicals manufacture, from the C_{11} to C_{17} olefins.

The above illustrations are only a few of the features that have already been disclosed by a study of a mass of data and records collected from the German plants and research laboratories. That this information is so quickly being made available to industry in general in this country is due to the insistence of PAW Director Davies that the data secured by the oil missions be released to the entire oil industry here and to schools and scientific institutions.

That the oil teams on the mission were able to do such a thorough job in sifting through the material picked up in the refineries and synthetic oil plants in Germany is due in part to the selection of the men on them. It was also due in good part to the fact the teams were briefed by the Technical Advisory Committee of PIWC before they went to Germany. TAC Secretary Albert E. Miller supplied the men with data on types of processes and operations they were likely to encounter in the German plants, as far as was known here.

History may prove that the knowledge thus carefully planned and arranged for, and now being prepared for distribution in this country, will be worth far more than all the material spoils and loot that might have been taken in the wake of our avenging armies.

Codimer Was Vital Contribution To the Early "Avgas" Program

THE books should not be closed on the oil industry's part in the winning of the war without great credit being given to the approximately 60 refineries, many of them small plants, who manufactured codimer for aviation gasoline. By converting their polymerization units to the production of this blending agent material, at the expense of motor fuel output, these plants contributed vitally to the supply of aviation gasoline in the early stages of the war, while the new 100-octane plants were being constructed.

"For the first hard years of the war, the codimer plants helped to bridge an awe-inspiring gap between the requirements of the armed forces and the ability of the industry to produce," said E. B. McConnell, Cleveland, of Standard Oil Company of Ohio, chairman of the Codimer Subcommittee of the Aviation Gasoline Advisory Committee of PIWC, in a final letter of appreciation to the codimer plant operators. Without codimer, he said, the production of aviation gasoline in that period could not have been brought to the volume which was then essential to the success of our war effort.

While total codimer production was only approximately 3% of total aviation gasoline output during the war, the timeliness of the supply made it a most material contribution from these many refineries. The total supply of codimer made at some plants was as little as 5 barrels a day, a very few produced as much as 2000 barrels. It was made by all plants without profit over what normally would have been made on motor fuel polymer.

Some benefits have accrued to the refining industry generally and some to the individual refineries as a result of the codimer program. In the development stages of the program, work was done on an actual plant scale that would not have been possible under peacetime operations. In operating thermal cracking units means were found to increase the yield of unsaturated compounds, which are desirable constituents of motor fuel. Studies of the effect of moisture content of the catalyst in polymerization operations and of catalyst poisoning served to increase both the product yield and the life of the catalyst. These developments will result in tangible benefits to the plants now switching their "poly" operations back to making motor fuel polymers. Likewise, many of the refineries in the codimer program will benefit from the advice of technologists of the large oil company research and development staffs who visited the plants in the field to lend their efforts to improving the individual operations.

These 60 refining plants, however, enlisted in the codimer enterprise to aid the aviation gasoline program without thought of other benefits that might accrue. Little glamour came from their individual efforts. Their total contribution will go into the record as one of the outstanding industry achievements of the war.

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